

Tactical TCB-4 First Responder Package

Users Manual

Version 1.0

**Link Communications, Inc.
1035 Cerise Road
Billings, Montana 59101**

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www.link-comm.com



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1.0 Introduction

1.1 Overview

The scope of this document is to aid in the installation, set-up of the Tactical TCB-4. Programming and operation of the unit will be covered under the Tactical Communications Bridge 2 (TCB-2) manual, which is included.

When questions arise, first refer to this manual, and if unable to locate a solution to your issue, contact Link Communications, Inc. (Link) technical support staff for resolution. Our preferred method of support is utilizing e-mail:

E-Mail support: support@link-comm.com

Telephone support is available for basic questions, theory of operation and configuration issues. Custom programming support is only handled via e-mail.

Phone support: +406-245-5002

1.2 Organization of the Installation Manual

The user manual is organized in two sections.

Section 2.0: Specifications and Layout

Section 3.0: Troubleshooting and Repair

Section 2.0: Specifications and Layout

2.1 Introduction

The Tactical TCB-4 First Responder Package include everything you need to become operational during a field deployment. The TCB-4's operation and interfacing will be described in three sections. Section 1 is the front side operation, section 2 is the back side operation, and the third section is the STI-CO antenna setup.

2.1.1 Front Side Interfacing



Front View: Tactical TCB-4 Package

The front of the TCB-4 provides access to the TCB-4, interfaced radio microphone ports, additional radios ports, conference bridging and the console operator position. The user can access individual radio transmissions by plugging in the included microphone to the desired radio, and operating it like a normal radio. The same Kenwood^(TM) microphones used to access the installed radios will also work as a local microphone with the TCB-4's microphone jack. Setup and operation is accomplished from the front panel touch screen, and is discussed in the TCB-2 manual, section 3.3.

VHF Radio Port

The VHF radio supports operation between 136 MHz .. 174 MHz. The radios are programmed with the Public Safety VTAC channels as well as the Federal Incident Response IR channels. This enables the package to operate in both Public Safety and Federal deployments.

VHF Preprogrammed Frequency List

The following outlines the preprogrammed frequencies setup in the VHF radio.

V-TAC Channels

Channel 1: 151.1375 V-Call
Channel 2: 154.4525 V-TAC1
Channel 3: 155.7525 V-TAC2
Channel 4: 158.7375 V-TAC3
Channel 5: 159.4725 V-TAC4

NTIA VHF Incident Response Channels

Channel 1: 169.5375R/164.7125T NC1 Calling
Channel 2: 170.0125R/165.2500T IR 1
Channel 3: 170.4125R/165.9625T IR 2
Channel 4: 170.6875R/166.5750T IR 3
Channel 5: 173.0375R/167.3250T IR 4
Channel 6: 169.5375/Simplex IR 5
Channel 7: 170.0125/Simplex IR 6
Channel 8: 170.4125/Simplex IR 7
Channel 9: 170.6875/Simplex IR 8
Channel 10: 173.0375/Simplex IR 9

Radio Programming Definitions

Because of the lack of standards for V-TAC and IR channels use of CTCSS tones, the TCB-4 VHF radio is programmed with the “accepted” standard tone of 156.7 Hz and the optional of 167.9 Hz (Federal Incident Response Channels Only).

On V-TAC channels, 156.7 Hz CTCSS is always transmitted. This enables radios that require CTCSS to always “hear” the transmission. CTCSS access to the TCB-4 radios is only required on channels that display the **-T** in the channel name. 156.7 Hz is the only CTCSS tone preprogrammed into the V-TAC channels. Custom programming requires the Kenwood programming software, available from Link Communications.

The radios are also configured to operate in either High Power mode (25W) or Low power mode (5W). The channel is identified as **-L** for low power and has no options displayed for High power.

For Example: V-CALL channel displayed as V-CALL-T-L

This channel will transmit and receive on 151.1375, narrow modulation, CTCSS 156.7 Hz required for access operating on low power.

For Example: Incident Response Channel 1 displayed as IR1-167.9-L

This channel will transmit on 165.25000 and receive on 170.0125, narrow modulation, CTCSS 167.9 Hz required for access operating on low power.

UHF Preprogrammed Frequency List

The following outlines the preprogrammed frequencies setup in the UHF radio.

U-TAC Channels

Channel 1: 458.2125 U-Call
Channel 2: 458.4625 U-TAC1
Channel 3: 458.7125 U-TAC2
Channel 4: 458.8625 U-TAC3

NTIA UHF Incident Response Channels

Channel 1: 410.2375R/419.2375T NC2 Calling
Channel 2: 410.4375R/419.4375T IR 10
Channel 3: 410.6375R/419.6375T IR 11
Channel 4: 410.8375R/419.8375T IR 12
Channel 5: 413.1875 Simplex IR 13
Channel 6: 413.2125 Simplex IR 14
Channel 7: 410.2375 Simplex IR 15
Channel 8: 410.4375 Simplex IR 16
Channel 9: 410.6375 Simplex IR 17
Channel 10: 410.8375 Simplex IR 18

Radio Programming Definitions

Because of the lack of standards for U-TAC and IR channels use of CTCSS tones, the TCB-4 VHF radio is programmed with the “accepted” standard tone of 156.7 Hz and the optional of 167.9 Hz (Federal Incident Response Channels Only).

On U-TAC channels, 156.7 Hz CTCSS is always transmitted. This enables radios that require CTCSS to always “hear” the transmission. CTCSS access to the TCB-4 radios is only required on channels that display the **-T** in the channel name. 156.7 Hz is the only CTCSS tone preprogrammed into the U-TAC channels. Custom programming requires the Kenwood programming software, available from Link Communications.

The radios are also configured to operate in either High Power mode (25W) or Low power mode (5W). The channel is identified as **-L** for low power and has no options displayed for High power.

For Example: U-CALL channel displayed as U-CALL-T-L

This channel will transmit and receive on 458.2125, narrow modulation, CTCSS 156.7 Hz required for access operating on low power.

For Example: Incident Response Channel 12 displayed as IR12-156.7-L

This channel will transmit on 419.8375 and receive on 410.8375, narrow modulation, CTCSS 156.7 Hz required for access operating on low power.

I-TAC or NPSPAC Preprogrammed Frequency List

The following outlines the preprogrammed frequencies setup in the 800 MHz radio. The naming convention for the 800 MHz frequencies is somewhat different depending who you ask. Public Safety entities refer to the 800 MHz channels as NPSPAC (National Public Safety Planning Advisory Committee). The 800 NPSPAC frequencies are available for both Public Safety and Federal operations. These frequencies generally require 156.7 Hz CTCSS so two channel types are supported. One channel group only transmits CTCSS (without the -T), and the other channel group both generates CTCSS and requires CTCSS for receive. This channel group is identified with the -T in the channel name.

I-TAC/ NPSPAC Channels

Channel 1: 866.0125 I-Call
 Channel 2: 866.5125 I-TAC1
 Channel 3: 867.0125 I-TAC2
 Channel 4: 867.5125 I-TAC3
 Channel 5: 868.0125 I-TAC4

Radio Programming Definitions

The 800 MHz radio used does not allow the power to be programmed in as a parameter. The power defaults as High (15 Watts), but can be adjusted down using the Kenwood programming software (Available from Link Communications).

Front Panel Radio Connections and Controls



TK-7180 and TK-8180 Radio

There are several buttons located on the front of the radio that can be used to control and operate the radio. The only external connection is the external microphone jack located on the left side of the radio. A microphone is included with the Tactical TCB-4 package.



To control the radio's power, press and hold the button until the radio powers on/off



To control the front panel speaker volume, use the 'Up' and 'Down' buttons. This will not effect the level of the audio feeding the TCB-4 unit, they only control the front panel speaker volume. To kill the speaker audio, press the 'Down' arrow until the audio is at level '0' or muted.



The Triangle controls the LCD display brightness.



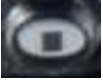
The 'S' button controls the radio scanning function. When this button is pressed, the radio scans all available channels looking for an active one.



The 'A' button is not used nor assigned to a radios function.



The 'B' and 'C' buttons control the changing of channels within a radio group. The LCD display will change the channel number, and name of the channel when the channel buttons are used.



The Square button recalls the radios clock.



The Double Up and Down arrows control the selection of different zones. Each zone contains the same frequency information but controls the transmit power setting and the use of CTCSS requirement. To control power and tone simply press the Up or Down to configure the radio like you need.



The TK-980 radio is used to interface to the NPSPAC and other conventional 800 MHz radio channels. The radio can operate in both narrow and wide modulation modes.

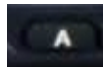
TK-980 Radio



To control the radio's power, press and hold the button until the radio powers on/off



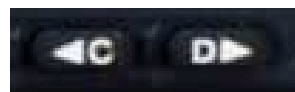
To control the front panel speaker volume, use the 'Up' and 'Down' buttons. This will not effect the level of the audio feeding the TCB-4 unit, they only control the front panel speaker volume. To kill the speaker audio, press the 'Down' arrow until the audio is at level '0' or muted.



The 'A' button is not used nor assigned to a radios function.



The 'B' button is not used nor assigned to a radios function.



The 'C' and 'D' buttons control the changing of channels within a radio group. The LCD display will change the channel number, and name of the channel when the channel buttons are used.



The 'SCN' button controls the radio scanning function. When this button is pressed, the radio scans all available channels looking for an active one.



The right hand Up and Down arrows control the selection of different zones. Each zone contains the same frequency information but controls the transmit power setting and the use of CTCSS requirement. To control power and tone simply press the Up or Down to configure the radio like you need.

TCB-4 Front Panel Connections and Controls



The TCB-4 provides the controls necessary to interface a local microphone, local headphone, additional radio and Ethernet.

The local microphone port is compatible with the Kenwood microphones included with the Tactical TCB-4 system. A PTT on the microphone will cause the selected port, or group to transmit. The microphone PTT provides the same function as the on-screen PTT button.

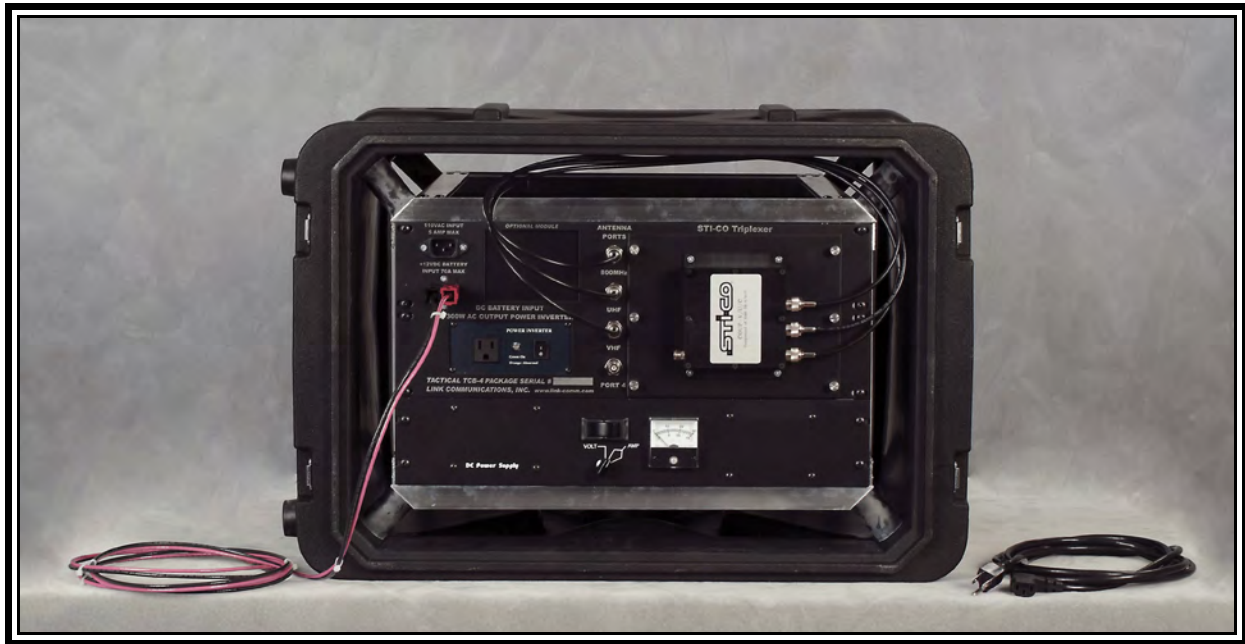
TCB-4 Controls

The headphone jack is a standard 1/8" stereo headphone connector, and mutes the local speaker when inserted. The local volume adjustment controls the level in either the local speaker or the connected headphones.

When connecting a additional radio to the TCB-4, the user can utilize the Port/Local connector. This connector is connected to the TCB-4 on Port 2. When utilizing the VoIP feature of the system, Port/Local is not available. If additional ports are necessary, the user can install four additional ports by inserting dual port DSP radio cards (Contact Link Communications for additional information and cost).

External computer control is accessed from the front panel Ethernet 10/100 connector. If plugging your TCB-4 directly to a computer, without a hub or switch installed requires a cross-over cable. When connecting the TCB-4 to a hub or switch, direct connection cables can be used. The Ethernet port is only used when computer controlling the TCB-4 or updating system firmware. If not used simply leave the port disconnected.

2.1.2 Rear Side Interfacing



Rear View: Tactical TCB-4 Package

The Tactical TCB-4 provides all the power connections that are needed to interface your communications system. Access to the AC input, DC input, Power Inverter and Antenna connections are available on the Rear of the TCB-4.

Rear Panel Connections

The Tactical TCB-4 can operate from External AC voltage, ranging from 85VAC to 240VAC, single phase, 50Hz ~ 60Hz frequency. When AC is present, the +12VDC battery connector is powered to allow for battery charging of an external connected battery, if present. When AC is removed, the TCB-4 automatically switches over to the battery for its operation. There is no noticeable switch-over when going between AC and DC/Battery.



The master power switch is located to the left of the AC voltage/current meter. When switched ON, the power supply will provide up to 50 Amp intermittent or 37Amps continuous duty current. When the meter selection switch is on "VOLT", voltage will be displayed.

When the switch is on either "AMP" positions, current will be displayed. There are two "AMP" switches because the power supply has two power supplies for better reliability. Each power supply provides up to 25 Amps of current. If one of the supplies fail, then the TCB would still operate, just under a limited current handling condition. To calculate the current of the system, add the current readings present on AMP position 1 and AMP position 2.



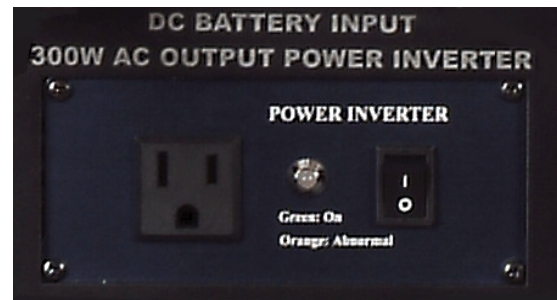
External AC is connected utilizing the standard IEC power connector. Voltage ranging between 85 VAC and 240VAC is accepted by the TCB-4's power supply. Under full load (37 DC amps), the AC input current will not exceed 5 AMPS.

When AC is present, the power supply will provide up to 8 amps of charging current to the external battery bank. When AC fails, DC is electronically switched to operate the TCB-4.

External battery input is available from the Anderson Power Pole^(TM) connector. These connections can handle up to 70 AMPS of current. When operating the TCB-4 from external DC/Battery, the 300W AC power inverter is available for use.

Power Input Connectors

The Tactical TCB-4 package includes an external 300W True Sine Wave AC power inverter. This feature enables the users, when operating from an external Battery/DC input, to generate up to 300W of AC voltage to operate computers, charge radios and operate low current lighting. When loaded to its maximum of 300W, the Inverter will provide 2.72 Amps of AC Power for operation. The inverter will only operate when external Battery/DC is provided. Under full-load, approximately 30 Amps DC will be needed to power the Inverter.



300W AC Power Inverter



Tri-Band Antenna Coupler

The ease in installing the Tactical TCB-4 is in part due to the antenna system included with the package. The STI-CO^(TM) Triband antenna system allows the TCB-4 to operate with a single antenna, and single coax run, for three bands. The antenna will support VHF, UHF and 800 MHz, with an option for Aircraft operation. When operating four radios, you will need to provide the antenna for the fourth radio, and connect the antenna to the connector marked PORT 4.

Antenna attachment involves attaching the antenna coax connector to the 'TNC' style of connector located on the STI-CO black antenna coupler box. Once connected you are ready to operate with the STI-CO antenna.

2.1.3 Antenna Assembly and Setup

The Tactical TCB-4 package includes the modern looking STI-CO_(TM) Triband antenna system. Utilizing the antenna, only one coax connection is required to get the TCB-4 operational on three bands (VHF, UHF and 800 MHz). If your system is outfitted with an aircraft radio, operating on 121 MHz, a fourth band can be supported. You will need to order the TCB-4 with the fourth band in order to operate on the additional radio frequency.



Tactical TCB-4 Antenna

When the antenna is broken down, it is composed of 4 pieces.

- 1) Antenna and Coax
- 2) Eight ground radials
- 3) Expandable Antenna mast
- 4) Tripod with extendable legs

The only assembly on the antenna is the attachment of the ground radials to the bottom plate. The plate is steel so the magnetic mount of the antenna will stick to the plate. Ground radials attach using quick connect-disconnect steel ball-joint. To attach, simply pull-back the connector head (spring loaded) and place on the ball assembly located on the steel plate, and release. The radial is now attached. Install all eight radials for the best operation on the VHF band. Once the radials are installed, attach the antenna, extend the mast and secure the tripod. The tripod legs will extend providing a solid base for the antenna.

The Tactical TCB-4 First Responder system provides the user with an easily transported, expeditionary field communications system. In its factory configuration, three installed radios provide the needed communications on VHF, UHF and 800 MHz, with support for a common network specific fourth radio. Only two connections are required for operation, Power and the antenna connector. It can be deployed in a matter of minutes.

Section 2.0: Specifications and Layout

2.1 Introduction

All cards on the TCB-4 are static sensitive devices. Use caution when handling them.

The TCB-4 Tactical interface is comprised of up to six system modules that provide the control and audio processing functions. One Digital Processing Module (DPM) is required to provide the control functions. Up to five other modules can be installed, each of which can be a Dual Radio Interface Module (DRIM) or Telephone Interface Module (TIM), in any combination.

Digital Processing Module (DPM)

This module is the unique module, and is located in the slot nearest to the power input. This card must be installed in the correct slot for the TCB to operate. The DPM card contains all the system memory, I/O and color LCD display interface controlling. The user should never need to remove or tamper with this module. There are no user adjustments needed on this module.

Specifications:

- Motorola MCF5272 RISC uProcessor
- 512K Battery backup memory
- 16 Megabytes non-volatile Flash memory
- 16 Megabytes high speed SDRAM system memory
- Real time clock with battery backed operation



The **Ethernet** connector uses a standard RJ-45 connector. When active, the Green LED's on the connector will light. When receiving data, the Yellow LED will light. This connector is designed to plug into a hub/switch with a straight thru cable. To directly connect to a computer you will need the red cross-over cable. Both cables are included with the TCB-4.

The **RS-232** connector uses a DB-9 female connector. It is configured as a DCE device therefore it can directly plug into your computer's serial port. This port is used for custom user programming, debugging and uploading new firmware when an Ethernet port is not available. The baud rate for this port is configured from the TCB-4's **SYSTEM SETUP** screen. The RS-232 serial port defaults to 115K Baud.

The **USB** connector is not currently supported.

Digital Processing Module (DPM)

Dual Radio Interface Module (DRIM)

The dual radio interface module handles the interface requirements for the users radio interfacing. Each module contains (2) RJ-45 8 wire conductor connectors. All radio interfacing requirements use these connectors.

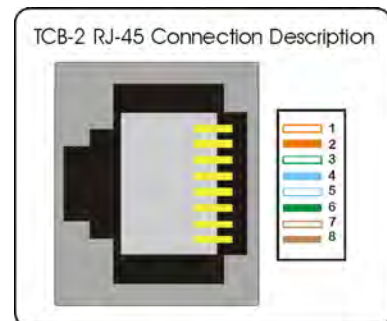


The top connector on the Radio Card is the Odd numbered radio ports. Top connectors support ports 1,3,5,7,9.

The bottom connector on the Radio Card is the Even numbered radio ports. Bottom connectors support ports 2,4,6,8,10.

Dual Radio Interface Module (DRIM)

The RJ-45 pinout for the TCB-4 is based on a standard CAT-5 cable color code. This connector can be internally configured to allow both balanced and non-balanced audio input/output. This connector also provides COR and CTCSS external control inputs, and a PTT output. The COR and CTCSS inputs are both opto-isolated with 5000V barrier isolation. A dry-contact PTT output is also available with several configurations to adapt to a variety of installation requirements. An external reference pin is also provided to allow complete intrinsically safe interfacing.



RJ-45 Radio Connector

Pin 1: White/Orange	Push To Talk (PTT)
Pin 2: Orange	COR Detect Input, +12V bias (*)
Pin 3: White Green	CTCSS Detect Input, +12V bias (*)
Pin 4: Blue	Audio Output Low
Pin 5: White/Blue	External Reference/Ground Reference
Pin 6: Green	Audio Output Hi
Pin 7: White/Brown	Audio Input Low
Pin 8: Brown	Audio Input Hi

(*) +12V bias COR/CTCSS inputs must be taken to ground to activate the opto-isolator. Verify your radio can drive load before connection.

Telephone Interconnect Module (TIM) option

The Telephone Interconnect Module adds support for (2) Analog telephone lines (POTS). These lines can be used for Dynamic Telephone Linking (DTL). When configured as a DTL, and when the telephone port is included in a group, activity from the included group will cause the unit to dial a pre-determined telephone number when the group goes active. This enables the TCB-4 to contact you when an event occurs, or to easily link two TCB-4 systems together utilizing a telephone line. See Section 3.3.5.6 for more information about setting up the TIM.



Telephone Interconnect Module

There is only one connector on the TIM for connection to a phone line. Included with the module is a 2-line to 2-connectors adapter if telephone line breaking is required. Line 1 is the inside pair (Red/Green) and Line 2 is the outer pair (Black/Yellow). If the two-line adapter is not used, only line 1 will be accessible.

The TIM plugs into a radio slot, and replaces the two radio ports that would otherwise be

provided by a dual radio interface module with two telephone line connections (on one connector). Therefore a loaded TCB-4 with the TIM installed can handle 8 radio ports and 2 telephone ports.

2.2 Radio Port Configuration Settings

The RJ-45 connector used for a radio interface can be configured to handle most interface applications. The factory default settings configure the radio port to handle the TCB's pre-fabricated radio cables. It is important to fully understand your interfacing requirements before changing the setting of the configuration switches. Incorrect switch settings can affect the operation of the interfaced radio. The switches are located on the rear of the Radio Module card.

All cards are shipped with settings for the Pre-Fabricated Radio Cables (See Section 2.2.1)

Switch Definitions

Switches 1,2,3 are designed for configuring your radio's PTT requirement. Your radio's PTT requirement will determine the settings of these switches.

Switch 1: Connect PTT to the Audio Output Lo side of the transformer (Default)

On radios that do not have a dedicated PTT, a lo-side transformer configuration is required. In this configuration, the radios PTT is carried through the microphone audio line. When the radio needs a PTT, the PTT signal pulls the transmit audio to a lower resistance and the radio transmits.

Switch 2: Connect PTT to TCB-4's ground

On radios where there is a dedicated PTT input (Mainly Mobile Radios), a PTT reference to ground is needed. When a PTT condition is needed, the PTT signal will be grounded when in transmit, and will be open in receive.

Switch 3: Connect PTT to the External Reference pin

On radios where a keying voltage is required, or system isolation is needed, the PTT would be set-up to use the external reference pin. This pin (RJ-45 pin 5), is available to allow custom keying reference configurations. When connecting Intrinsically safe radios, to the TCB-4, no unit grounding is allowed. In this example, the user would turn switch 3 ON and connect the radio's ground (which is different from the TCB's ground) to the PTT signal. When the TCB required a PTT condition, the PTT would present the radios externally isolated ground to the radio for causing a PTT to occur.

Note:

When Switch 2 and Switch 3 are both ON, the RJ-45's pin5 (External Reference) is connected to the TCB-4's ground reference. This allows a common ground to be available for external devices. When utilizing this ground, your external ground should be connected to pin 5 located on the RJ-45 connector. **DO NOT HAVE SWITCHES 4 AND 5 BOTH 'ON' IN THIS CONFIGURATION.** It will connect +Vinput (12V) to ground, causing the cards output limiting fuse to open.

Switches 4,5 control what source powers the opto-isolators used for external COR and CTCSS detection. In the default position, the TCB-4 powers the anode of the opto-isolator, allowing an external ground to indicate that either the COR/CTCSS pin is active. When configuring the TCB for intrinsically safe operation, and where an external COR/CTCSS signal is required, the switch would be configured to use the external reference pin.

Switch 4: Connect the Optical Isolated Anode line to the TCB's +Vinput (Default)

This switch determines if the COR/CTCSS opto-isolators on the TCB's radio cards are powered from the TCB's power supply or an external reference. When "ON", the opto-isolators use the +Vinput that powers the TCB-4. This is a non-isolated condition.

Switch 5: Connect the Optical Isolated Anode line to the External Reference pin

This switch determines if the COR/CTCSS opto-isolators on the TCB's radio cards are powered from the External Reference line (RJ-45 pin 5). When "ON", the opto-isolators use the External Reference line to power the opti-isolators. The opto-isolator and handle voltage up to +48V DC. A ground on either the COR or CTCSS line will cause the opto-isolator to turn on, thus providing a valid COR/CTCSS condition.

Switches 6, 7, 10 control what type of receiver audio is required. The default audio input is balanced, 2-wire input. The load the radio will see in balanced mode is 600Ω. When a higher input load is required, and isolated input is not required, then un-balanced receiver audio is selected. The receiver load, in unbalanced configuration, is 47KΩ.

When connecting a radio's speaker to the audio input, balanced mode is required. Most of the handheld radios utilize "above ground" driving to power the speaker. If balanced audio is selected, the user would then connect the Audio-In Hi (pin 8) and the Audio-In Lo (pin 7) to the speaker +/- wires of the radio. This connection will ensure isolation from the radio's ground. It is important to know what your radio requires on the speaker interface. You can damage the radio's audio circuits if you connect the audio incorrectly.

Balanced Audio Input: Switches 6,10-On, Switch 7-Off (Default)

Un-Balanced Audio Input: Switches 6,10-Off, Switch 7-On

Switches 8, 9 control what type of transmitter audio is required. The default audio output is balanced, 2-wire output. The load the radio will see in balanced mode is 600Ω. When a single wire output is required, and isolated input is not required, then un-balanced transmitter audio is selected. The transmitter load, in unbalanced configuration, is 600Ω.

Balanced Audio Output: Switch 8-On, Switch 9-Off (Default)

Un-Balanced Audio Output: Switch 8-Off, Switch 9-On

Switch ON/OFF definition











When a switch is referred to being “On”, the little tab on the switch is slid to the “On” indicator. Make sure when changing the position of a switch, that the switch tab is firmly slid to the position required.

Switch configuration reference

On the back of each of the Dual Radio Module, there is a table referenced “Switch Settings” that outlines the definition of each switch. Only change the 10 position switch when configuring the audio. The 8 position switch on the back of the board is for configuring the RS-232 ports which will be covered later.

2.2.1 TCB's Pre-fabricated radio cables (Factory Default Setting)

The default setting of the TCB-4's radio port supports the TCB's pre-fabricated radio cables. Typically the switch settings do not need to be changed. In certain applications, the switch settings will need to be changed.

1		On	Switch 1: (On) PTT connected to the Lo-side of the Transmit Audio
2		On	Switch 2: (Off)
3		On	Switch 3: (Off)
4		On	Switch 4: (On) Opto-Isolator Anode connected to TCB +Vinput
5		On	Switch 5: (Off)
6		On	Switch 6: (On) Balanced Receiver Audio Selected
7		On	Switch 7: (Off)
8		On	Switch 8: (On) Balanced Transmit Audio Selected
9		On	Switch 9: (Off)
10		On	Switch 10: (On) Balanced Receiver Audio Selected

RJ-45 Pin-Out for this configuration

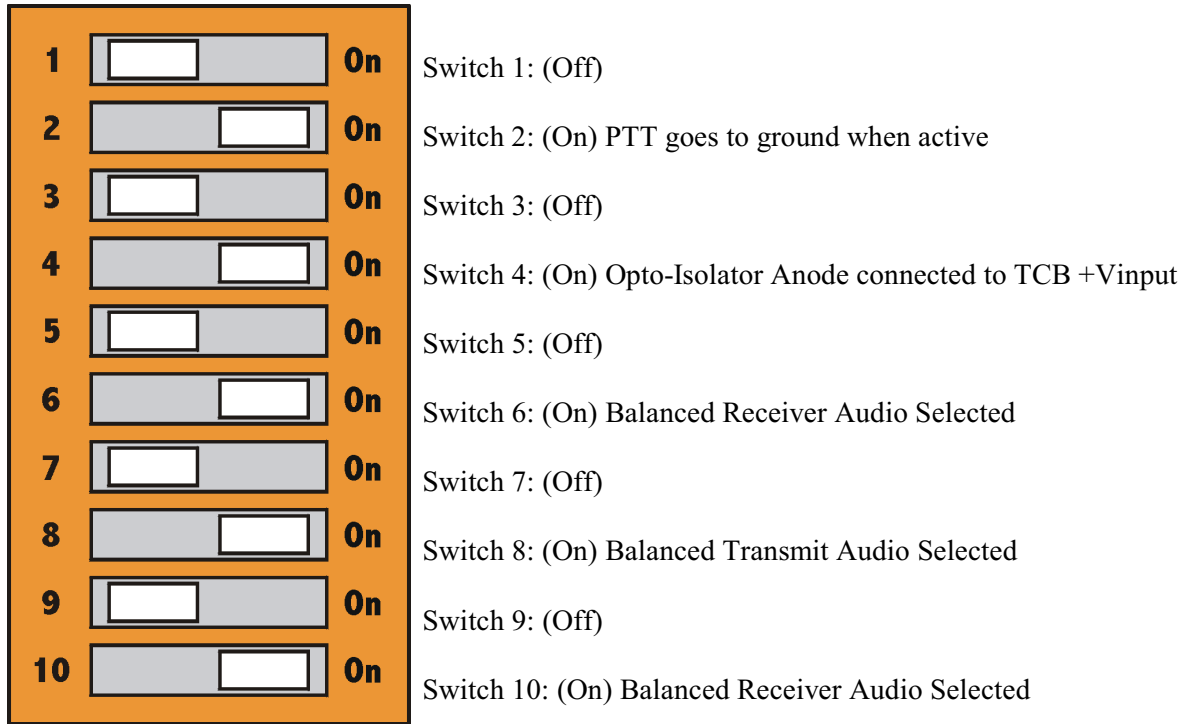
- Pin 1 - (CAT 5: White/Orange) PTT Output - Connectes to Audio Output Lo on Transmit
- Pin 2 - (CAT 5: Orange) COR Input - Configures the TCB-4 that the Receiver is active
- Pin 3 - (CAT 5: White/Green) CTCSS Input - Configures the TCB-4 that a CTCSS is active
- Pin 4 - (CAT 5: Blue) Audio Output Lo - Connected to the PTT signal
- Pin 5 - (CAT 5: White/Blue) External Reference Input - Not Used
- Pin 6 - (CAT 5: Green) Audio Output Hi - Connects the radio microphone input connector
- Pin 7 - (CAT 5: White/Brown) Audio Input Lo - Connects the radio's speaker Lo pin
- Pin 8 - (CAT 5: Brown) Audio Input Hi - Connects the radio's speaker Hi pin

Software Set-up for this configuration

All ports default to the VOX receiver active state. No software set-up changes are needed.

2.2.2 TCB's Balanced In/Out w/E&M contact closure Signaling

When connecting the TCB-4 to a balanced radio system, where COR and CTCSS signaling is available, it is necessary to change switch settings along with changing port set-up features under the port set-up menu (LCD Screen Menu).



RJ-45 Pin-Out for this configuration

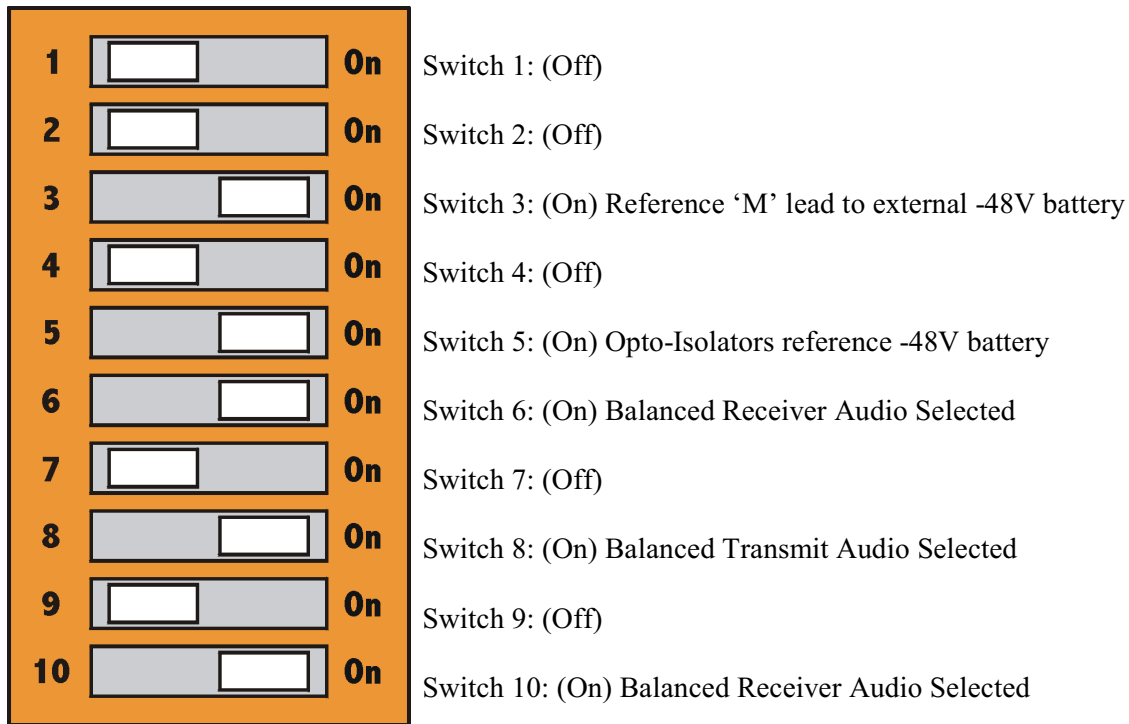
- Pin 1 - (CAT 5: White/Orange) PTT Output - Connect to M-Lead. Goes to ground on Transmit
- Pin 2 - (CAT 5: Orange) COR Input - Connect to E-Lead. Low when Receiver is active
- Pin 3 - (CAT 5: White/Green) CTCSS Input - Not Used
- Pin 4 - (CAT 5: Blue) Audio Output Lo - Connected to Balanced Audio Input Lo
- Pin 5 - (CAT 5: White/Blue) External Reference Input - Not Used
- Pin 6 - (CAT 5: Green) Audio Output Hi - Connected to Balanced Audio Input Hi
- Pin 7 - (CAT 5: White/Brown) Audio Input Lo - Connect to Audio Output Lo
- Pin 8 - (CAT 5: Brown) Audio Input Hi - Connect to Audio Output Hi

Software Set-up for this configuration

- 1) Under the Operations Setup Screen select the port (1..10) that this configuration applies to
- Press Port number and the Set-up button
- 2) Select from the Radio personality screen the preprogrammed personality "Balanced1" then press the SELECT button.
- 3) Press the EXIT button, set-up is already completed and stored.

2.2.3 E&M Type 2/3, 4 Wire Interface

When connecting the TCB-4 to a VOIP or similar router that requires an E&M Type 2 or Type 3 interface, balanced and opto-isolated inputs are required. The TCB-4's flexible interface configuration supports this common format.



RJ-45 Pin-Out for this configuration

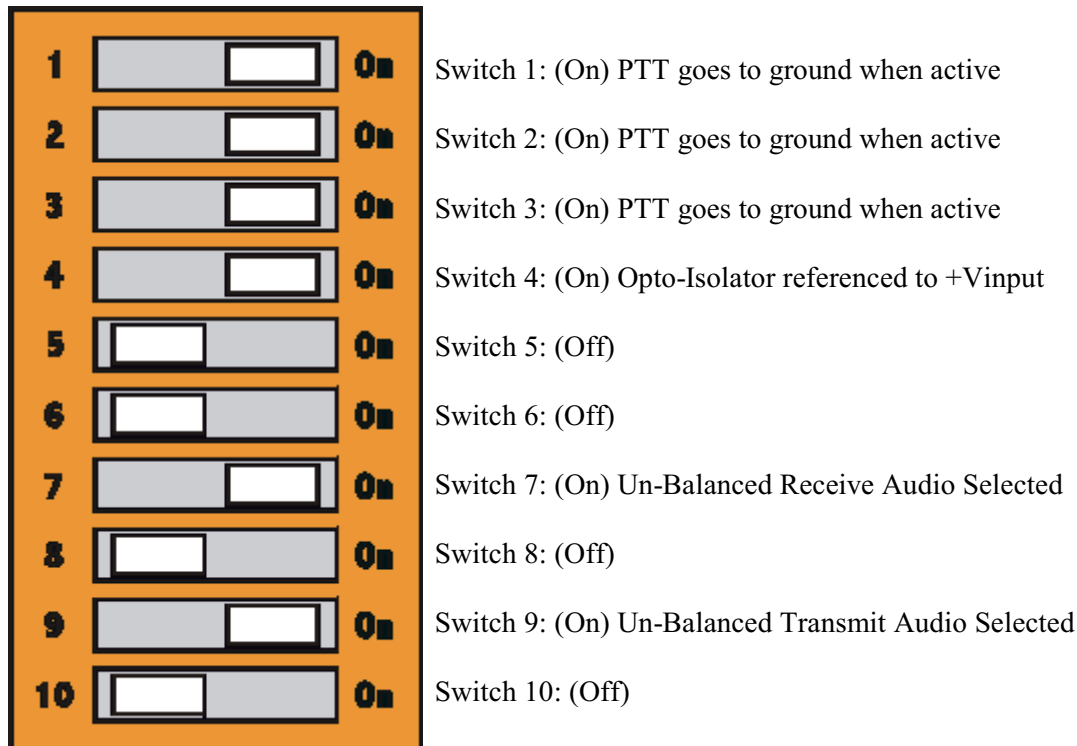
- Pin 1 - (CAT 5: White/Orange) M lead Output - Connect to M lead, pin 2 (Orange)
- Pin 2 - (CAT 5: Orange) E lead Input - Connect to E lead, pin 7 (White/Brown)
- Pin 3 - (CAT 5: White/Green) CTCSS Input - Not Used
- Pin 4 - (CAT 5: Blue) Audio Output Lo - Connect to Ring Audio Output, pin 3 (White/Green)
- Pin 5 - (CAT 5: White/Blue) External Reference - Connect to -48V battery, pin 1 (White/Orange)
- Pin 6 - (CAT 5: Green) Audio Output Hi - Connect to Ring1 Audio Output, pin 4 (Blue)
- Pin 7 - (CAT 5: White/Brown) Audio Input Lo - Connect to Tip Audio Input, pin 6 (Green)
- Pin 8 - (CAT 5: Brown) Audio Input Hi - Connect to Tip1 Audio Input, pin 5 (White/Blue)

Software Set-up for this configuration

- 1) Under the Operations Setup Screen select the port (1..10) that this configuration applies to
- Press Port number and the Set-up button
- 2) Select from the Radio personality screen the preprogrammed personality "E&M 2/3" then press the SELECT button.
- 3) Press the EXIT button, set-up is already completed and stored.

2.2.4 Un-Balanced Audio In/Out with COR/CTCSS signaling

When connecting the TCB-4 to a mobile radio, or repeater set-up, non-balanced audio and COR/CTCSS signaling is typically required. In this mode, the COR and CTCSS will connect to the opto-isolators and there will be a reference ground. The Ground reference is available on Pin 5. It is very important to verify that Switch 5 is off. If the switch is incorrectly in the ON position, +Vinput and Ground will be connected causing the resettable fuse on the radio card to blow.



RJ-45 Pin-Out for this configuration

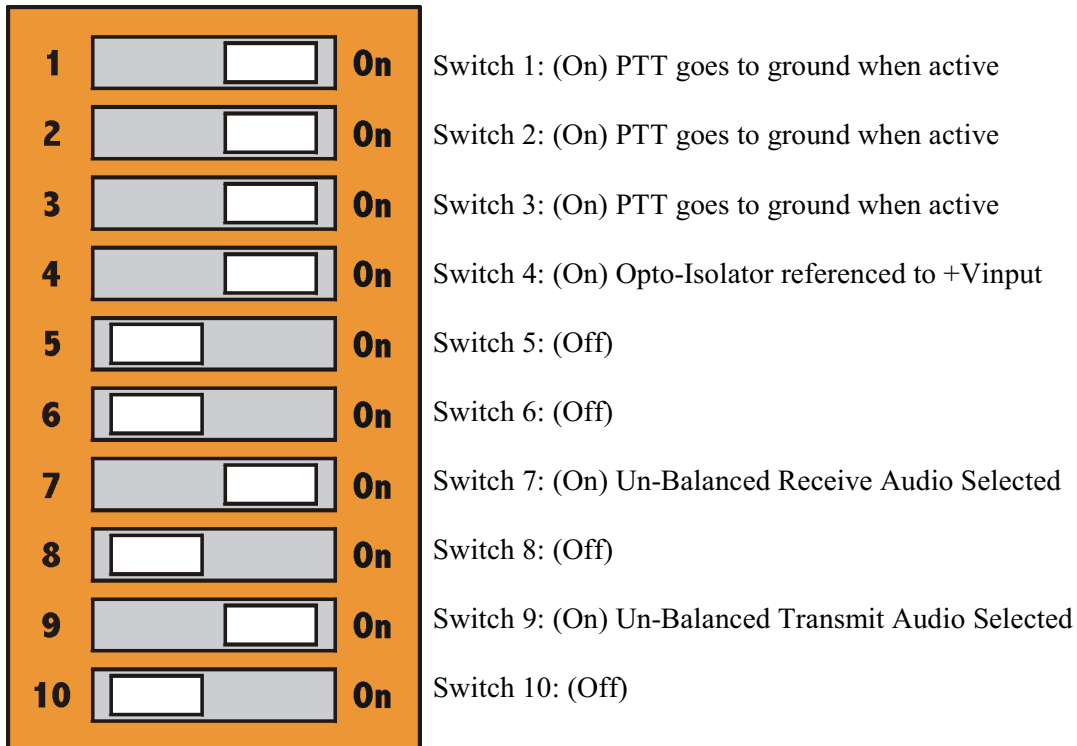
Pin 1 - (CAT 5: White/Orange) PTT Output - PTT signal goes to ground on Transmit
 Pin 2 - (CAT 5: Orange) COR Input - Active Low COR (Can be inverted in set-up)
 Pin 3 - (CAT 5: White/Green) CTCSS Input - Active Low CTCSS (Can be inverted in set-up)
 Pin 4 - (CAT 5: Blue) Audio Output Lo - Not Connected
 Pin 5 - (CAT 5: White/Blue) External Reference - Connector to your Radio Ground
 Pin 6 - (CAT 5: Green) Audio Output Hi -Connect to Transmit Audio Input
 Pin 7 - (CAT 5: White/Brown) Audio Input Lo - Not Connected
 Pin 8 - (CAT 5: Brown) Audio Input Hi - Connect to Receiver Audio Output

Software Set-up for this configuration

No software set-up is needed. This port configuration is considered as an unbalanced port.

2.2.5 RS-232 Serially Controlled Radio

Each of the radio ports on the TCB-4 supports its own RS-232 serial port. The serial port is normally disconnected. When needed the user must set-up both the Radio A or Radio B dip switch setting, additionally the RS-232 configuration dip switch needs configuration. This dip switch is located on the back of the Radio card, and is an 8 position configuration. Let us start with the Radio configuration dip switch settings first.



RJ-45 Pin-Out for this configuration

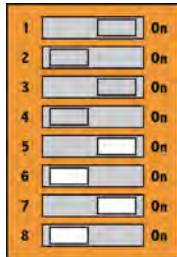
- Pin 1 - (CAT 5: White/Orange) PTT Output - PTT signal goes to ground on Transmit
- Pin 2 - (CAT 5: Orange) COR Input - Active Low COR (Can be inverted in set-up)
- Pin 3 - (CAT 5: White/Green) CTCSS Input - Active Low CTCSS (Can be inverted in set-up)
- Pin 4 - (CAT 5: Blue) Audio Output Lo - RS-232 Data Input (RX Data) (Pin3 on a DB-9)
- Pin 5 - (CAT 5: White/Blue) External Reference - Connector to Radio Ground (Pin5 on a DB-9)
- Pin 6 - (CAT 5: Green) Audio Output Hi - Connect to Transmit Audio Input
- Pin 7 - (CAT 5: White/Brown) Audio Input Lo - RS-232 Data Output (TX Data) (Pin2 on a DB-9)
- Pin 8 - (CAT 5: Brown) Audio Input Hi - Connect to Receiver Audio Output

Notice that Pin 4 and Pin 7 is reserved for RS-232 Transmit/Receive data. These pins will be configured to carry the radios data so it is very important to not connect any radio signals to these pins. On your radio cable, these pins will be available to connect to the radios RS-232 port to facilitate remote serial control of the radios features.

Enabling an RS-232 port on a Radio Port Connector

Locate Switch 3 on the back of the radio card. This switch is an 8 position switch assembly. Positions 5,6,7,8 are dedicated to Radio Port 1, and positions 1,2,3,4 are dedicated to Radio Port 2.

Enabling RS-232 on Radio Port A

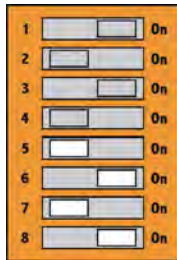


To Enable the RS-232 Port on Radio A, set switch 5,7-On and set switch 6,8-Off position.

RS-232 data is now available on the Radio port.

- Pin 4: RS-232 Transmit Data, Pin 7: RS-232 Receive Data

Disabling RS-232 on Radio Port A



To Disable the RS-232 Port on Radio A, set switch 5,7-Off and set switch 6,8-On position.

Audio Output Lo signals are now available (Default Setting)

- Pin 4: Audio Output Lo, Pin 7: Audio Input Lo

Enabling RS-232 on Radio Port B

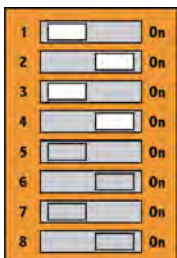


To Enable the RS-232 Port on Radio B, set switch 1,3-On and set switch 2,4-Off position.

RS-232 data is now available on the Radio port.

- Pin 4: RS-232 Transmit Data, Pin 7: RS-232 Receive Data

Disabling RS-232 on Radio Port B



To Disable the RS-232 Port on Radio B, set switch 1,3-Off and set switch 2,4-On position.

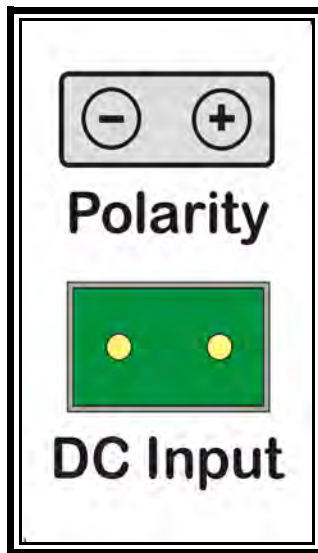
Audio Output Lo signals are now available (Default Setting)

- Pin 4: Audio Output Lo, Pin 7: Audio Input Lo

2.3 Power Requirements for the TCB-4

The TCB-4 Tactical Bridge operates from +12VDC with an accepted voltage input range of +11VDC to +18VDC. Do not exceed the voltage input range, as doing so can damage your TCB interface. The TCB-4's current requirement is a maximum of 1.5 Amps.

The power connector that is used on the TCB-4 is a polarized, latching style of connector. If voltage is applied to the TCB-4 reversed, the unit will not operate. The unit is protected against power supply polarity reversal.

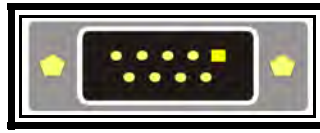


The Polarity of the rear panel DC power plug

The TCB-4 comes equipped with a 110VAC to 12VDC power adapter. The adapter is rated to handle 3 Amp's of current. Do not get the power supply, or the TCB-4 wet. Damage will occur.

2.3 RS-232 Serial Port

The RS-232 serial port on the Digital Processing Module allows the user to monitor and control operation of the TCB-4. This port is also used with computer GUI interface software for remote control of the interface.



RS-232 Serial Connector

The default parameters for this connector are as follows:

Baud Rate: 115.2 K Baud
Start Bit: None
Data Bits: 8
Stop Bits: 1
Flow Control: Software

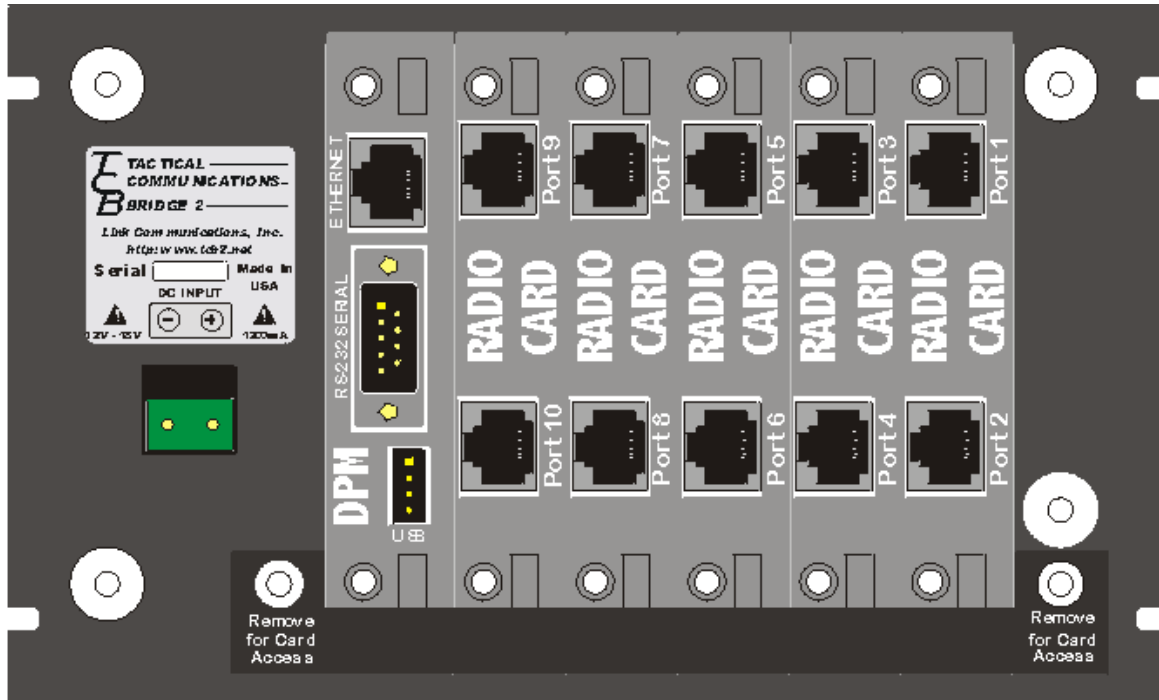
The pin-out for this connector:

Pin 1 - Tied to pin 4,6
Pin 2 - Serial Data Output from the TCB-4
Pin 3 - Serial Data Input to the TCB-4
Pin 4 - Tied to pin 1,6
Pin 5 - TCB-4 chassis ground
Pin 6 - Tied to pin 1,4
Pin 7 - CTS (Clear to Send)
Pin 8 - RTS (Ready to Send)
Pin 9 - Not Connected

2.4 Rear Panel Module and Connector Layout

The rear of the TCB-4 is where the Data Processing Module and the Radio Modules are installed. When adding and removing any of the modules, it is **REQUIRED** to remove the power from the TCB-4. Damage to the TCB-4 can occur if a card is added or removed while the power is applied.

The TCB-4 supports (5) Radio Modules and (1) Digital Processing Module. The total radio support is (10) channels. Radio module slots can also support option modules.



Removal of the TCB-4's Radio or Digital Modules

When adding or removing modules from the TCB-4, be sure to ground yourself to minimize any static damage that can occur. Do not touch the electronic components on the circuit board, and store the module in an antistatic approved bag or carrying device. Improper handling can cause damage to the module, requiring factory repair or replacement.

- 1) Remove power from the TCB-4 (Unplug the DC Input cable)
- 2) Remove the Rear Bracket, which hold the cards in the TCB-4
- 3) Gently grasp the two metal pull pins on the module you wish to remove. Apply a small “tug” and the board will slide out of the unit.
- 4) Place the module in an antistatic bag or holder for later use or return to Link Communications.
 ** Improper handling will void modules warranty. Must be returned in an antistatic bag **

- 5) Install the new module by lining up the module with the card guides inside the TCB-4.
- 6) Gently push on the two metal pull pins until the module is seated evenly. If the module is not pressed completely in, the TCB-4 will not operate correctly.

A correctly installed module will be flush with the rear panel.

- 7) Re-install the Rear Support Bracket for added module support.

Your TCB-4 is now ready for operation or configuration

Section 3.0: Programming and Set-up

3.1 Introduction

Welcome to the Programming and Set-up section. The goal for this part of the Users manual is to help in manipulating the TCB-4's front panel accessed commands. Additionally, commands that can be accessed using your DTMF pad or RS-232 serial terminal will be outlined. Advanced commands, structure and programming utilizing the RS-232 serial port will be discussed in the Advanced programming manual.

Programming the TCB-4 can be accomplished using DTMF tones, RS-232 Serial or the LCD Touch Panel on the front of the interface. These methods make the TCB-4 a very versatile interface for field configuration and changes.

3.2 Programming the TCB-4

3.2.1 DTMF Programming

When programming the TCB-4 utilizing DTMF, a security unlock is required. This unlock sequence defaults to *1234 and opens the TCB-4 up to command manipulation. The unlock code can be changed to any DTMF sequence from 1 to 6 digits in length. If your system is on an open radio channel, it is a good security practice to change this code often to minimize the chance of an unauthorized user gaining access.

The other DTMF programming codes all start with a '*', which is followed by two digits to identify the command, then a number of data digits (the number of data digits depends on which command is being executed). The commands generally mimic the operation of the front panel LCD display's operation, but have the advantage of being accessible from a remote location.

Once programming is completed, the user can exit the TCB-4's programming mode by entering the code '*#'. This will close the programming mode back to operation mode. The TCB-4 will store the programming changes into the non-volatile FLASH memory. If during any programming, the TCB-4's power switch is turned off, the TCB-4 will automatically take your programming changes and also write them to the FLASH memory system. If the TCB-4's power is interrupted during programming, all changes will be lost. So it is important to not interrupt power (by unplugging the TCB's power cord) when in programming mode.

DTMF Command	Description
*1234	<p>Enter Programming Mode (*1234): To change the unlock code, see Command *40</p> <p>Response: Low - High Beep: Programming mode accessed No Beep: Invalid code, system not accessed</p>
*#	<p>Exit Programming and Save Changes This command is executed when the user is completed with programming and wishes to exit programming mode and save. If this command is not executed, and power is removed from the TCB-4 (other than the power switch), the programming changes will not be saved. If the power of the TCB-4 is switched off with the power switch, all programming changes will be saved.</p> <p>Response: High - Low Beep: After changes are saved</p>
*00 G PP	<p>Add to a Group, a Port (*00 G PP): This command allows the user to add a radio Port to a Group. G = Group Number (Ranges from 1 to 5) PP = Radio Port Number (Ranges from 01 to 10)</p> <p>Response: Low - High Beep: Port added to group successfully Long Beep: Error encountered, try again</p>
*01 G PP	<p>Monitor a Group from a Port (*01 G PP): This command allows the user to Monitor a Group from a Port. The user will need to know what port to do the monitoring from. If the port (PP) is not known, then see Command *04. G = Group Number (Ranges from 1 to 5) PP = Radio Port Number (Ranges from 01 to 10)</p> <p>Response: High - High Beep: Port is now being monitored Long Beep: Error encountered, try again</p>

<p>*02 G PP</p>	<p>Remove from a Group, a Port (*02 G PP): This command allows the user to remove a radio Port from a Group. G = Group Number (Ranges from 1 to 5) PP = Radio Port Number (Ranges from 01 to 10)</p> <p>Response: High - Low Beep: Port removed from a group successfully Long Beep: Error encountered, try again</p>
<p>*03 G PP</p>	<p>Interrogate a Group for a Port (*03 G PP): This command allows the user to see if a radio Port is part of a Group. G = Group Number (Ranges from 1 to 5) PP = Radio Port Number (Ranges from 01 to 10)</p> <p>Response: High - Low Beep: Port is not part of selected group Low - High Beep: Port is part of selected group High - High Beep: Port Monitors Group Long Beep: Error encountered, try again</p>
<p>*04 G</p>	<p>Add to a Group, the Current Port (*04 G): This command allows the user to add the Current Radio Port to a Group. This is useful if you do not know what radio port you are operating from, but you do know what group you need to be part of.</p> <p>If the requested radio port is currently part on another Talk Group, this command will remove the radio and assign it to the requested group.</p> <p>Note: This command can only be execute using DTMF from a radio port.</p> <p>G = Group Number (Ranges from 1 to 5)</p> <p>Response: Low - High Beep: Port added to group successfully Long Beep: Error encountered, try again</p>

<p>*05 G</p>	<p>Monitor a Group from the Current Port (*05 G): This command allows the user to Monitor a Group from the current port the DTMF digits are entering from. If you are already monitoring a different group, that group will be canceled, and the requested group will be routed to your radio. G = Group Number (Ranges from 1 to 5)</p> <p>Response: High - High Beep: Port is now being monitored Long Beep: Error encountered, try again</p>
<p>*06 G</p>	<p>Remove from a Group, the Current Port (*06 G): This command allows the user to remove the current port from a group. G = Group Number (Ranges from 1 to 5)</p> <p>Response: High - Low Beep: Port removed from a group successfully Long Beep: Error encountered, try again</p>
<p>*07 G</p>	<p>See if Commanding port is part of a Group (*07 G): This command allows the user to interrogate if it's port is part of a group.</p> <p>Note: This command can only be execute using DTMF from a radio port.</p> <p>G = Group Number (Ranges from 1 to 5)</p> <p>Response: High - Low Beep: Port is not part of selected group Low - High Beep: Port is part of selected group High - High Beep: Port Monitors Group Long Beep: Error encountered, try again</p>

<p>*08 GC</p>	<p>Enable or Disable a Group (*08 G C): This command allows the user to Enable (Turn-On) or Disable (Turn-Off) a group. The group's members (Ports that are part of the Group), are not changed, simply whether the group is functioning or not. This command is useful when remote controlling of the TCB-4 is required, and you do not want the talk groups active unless otherwise needed. G = Group Number (Ranges from 1 to 5) C = Control Request. 1 = Enable the Group, 0 = Disable the Group</p> <p>Response: Low - High Beep: Group is now Enabled High - Low Beep: Group is now Disabled Long Beep: Error encountered, try again</p>
<p>*09 G</p>	<p>Interrogate if a Group is Enabled or Disabled (*09 G): This command allows the user to Interrogate if a Group is Enabled or Disabled. Group Enabling and Disabling is controlled with Command *06. G = Group Number (Ranges from 1 to 5)</p> <p>Response: Low - High Beep: Group is Enabled High - Low Beep: Group is Disabled Long Beep: Error encountered, try again</p>
<p>*10 PP M</p>	<p>Change a Port's Receiver Access Mode (*10 PP M): This command changes a ports Receiver access mode. The mode controls how the receiver is recognized by the interface cards.</p> <p>PP = Port Number (Ranges from 01 to 10) M = Receiver Access Mode 1 = COR Line: Receiver presents a COR on the RJ-45 2 = PL Line: External decoder presents a signal on the RJ-45 3 = VOX Detect: DSP detects receiver audio (Default) 9 = No Access: Receiver is turned off</p> <p>Response: High - High Beep: Access Mode is Changed Long Beep: Error Encountered, try again</p>

<p>*11 PP SSS V</p>	<p>Change a Port's VOX Characteristics (*11 PP SSS V): This command changes how the VOX operates. These settings allows the user to configure the VOX receiver detector to operate best for the receiver that is connected. A faster VOX will not wait as long to go from active to inactive, and a less sensitive VOX requires more audio energy to active it.</p> <p>PP = Port Number (Ranges from 01 to 10) SSS = VOX sensitivity setting (Ranges from 000 to 100%). A higher number lowers the VOX sensitivity and requires more audio energy to detect activity. In higher noise environments, adjust the sensitivity higher to cause the background noise to be ignored. V = VOX response time 0 = Slow VOX response (Waits the longest between words) 1 = Medium VOX response (Default) 2 = Fast VOX response (Waits the shortest between words)</p> <p>Response: First High - High: VOX Sensitivity Changed Second High - High: VOX Response Time Changed Long Beep: Error encountered, try again</p>
<p>*12 PP LLL</p>	<p>Adjust a Port's Receiver Level (*12 PP LLL): This command allows the ports Receiver level to be changed. This is helpful when the TCB is located remotely and changes are necessary. If AGC (Automatic Gain Control) is enabled, the TCB uses the Receiver Level as a reference starting point. The level is then automatically changed.</p> <p>PP = Port Number (Ranges from 01 to 10) LLL = Receiver Level from 000 to 100%</p> <p>Response: High - High: Receiver Level Changed Long Beep: Error encountered, try again</p>

<p>*13 PP A</p>	<p>Control a Receiver's AGC setting (*13 PP A): This command allows the ports AGC (Automatic Gain Control) to be enabled or disabled. If enabled, the TCB will adjust the Receivers audio level to a setting that best suits the interface card. If disabled, the Receivers audio level is used, and not changed. Command *12 sets the Receivers audio level. The audio sounds best, in most conditions, when the AGC setting is enabled.</p> <p>PP = Port Number (Ranges from 01 to 10) A = AGC control setting 0 = Enables the Receivers AGC Control (<i>Default</i>) 1 = Enable Manual Control (AGC Off)</p> <p>Response: High - High: Receiver AGC Level Changed Long Beep: Error encountered, try again</p>
<p>*14 PP M LLL</p>	<p>Adjust a Port's Transmitter Level (*14 PP M LLL): This command allows the ports Transmitter level to be changed. This is helpful when the TCB is located remotely and changes are necessary. The level is controlled from 0 to 100%. There are two level options. Line level is used when driving an input that requires more than -10dBv (into 600 Ω load) of audio. Line level output can drive +10dBv. Mic level is used when driving sensitive microphone inputs. Mic level output can drive -11dBv (into 600 Ω load). Line and Mic levels are controlled with Command *14.</p> <p>PP = Port Number (Ranges from 01 to 10) M = Transmit Range 0 = Microphone Input range: Max level = -11dBv into 600Ω 1 = Line Input range: Max level = +10dBv into 600Ω LLL = Transmit Level from 000 to 100%</p> <p>Response: High - High: Transmitter Level Changed Long Beep: Error encountered, try again</p>

<p>*15 PP</p>	<p>Selects a Port's Operational Mode as Radio (*15 PP): This command allows the operational functioning of a radio port to be adjusted. Handheld radios are half-duplex (when the radio is in transmit, the receiver is not active). On a handheld configured port, other ports activity controls the transmit on its port. It is important not to configure a handheld as a repeater as the port will not operate correctly.</p> <p>PP = Port Number (Ranges from 01 to 10)</p> <p>Response: High - Low Beep: Operating Mode Changed Long Beep: Error encountered, try again</p>
<p>*16 PP</p>	<p>Selects a Port's Operational Mode as Repeater (*16 PP): This command allows the operational functioning of a radio port to be adjusted. Repeaters are full-duplex (there is a separate receiver and transmitter and can both function simultaneously). When a port is configured as a repeater, the ports receiver activity causes a PTT transmit at the same time.</p> <p>PP = Port Number (Ranges from 01 to 10)</p> <p>Response: Low - High Beep: Operating Mode Changed Long Beep: Error encountered, try again</p>
<p>*17 PP TTT</p>	<p>Adjust a Port's Tone Level (*17 PP TTT): This command allows the ports Generated Tone level to be changed. This is helpful when the TCB is located remotely and changes are necessary. The level is controlled from 0 to 100%. Changes to the Tone levels are necessary when generating beeps, DTMF and any signaling information.</p> <p>PP = Port Number (Ranges from 01 to 10) TTT = Tone Level from 000 to 100%</p> <p>Response: High - High: Tone Level Changed Long Beep: Error encountered, try again</p>

<p>*18 PP VVV</p>	<p>Changes a Port's Transmitter Hang Timer (*18 PP VVV): This command allows the user to change a Ports Hang Timer. This timer controls how long the ports transmitter stays keyed after the connected receiver (s) go inactive.</p> <p>PP = Port Number (Ranges from 01 to 10) VVV = Hang Timer value in 10mS increments Default = 000 mS</p> <p>Response: High - High: Hang Timer Changed Long Beep: Error encountered, try again</p>
<p>*19 PP VVV</p>	<p>Changes a Port's Receiver Time-Out Timer (*19 PP VVV): This command allows the user to change a Ports Receiver Time-Out timer. This timer controls the maximum time a receiver can be active before the TCB no longer recognizes the receiver. This is useful to limit a persons talking time that can tie-up operation on the TCB-4.</p> <p>PP = Port Number (Ranges from 01 to 10) VVV = Receiver Time-Out Timer in 1 Sec. increments Default = 060 Sec</p> <p>Response: High - High: Receiver Time-Out Timer Changed Long Beep: Error encountered, try again</p>

20 PP VVV*Changes a Port's Initial Key-Up Delay Timer (*20 PP VVV):**

This command allows the user to change a ports Initial Key-Up Delay timer. This timer controls the amount of time a ports receiver is not recognized when it goes active initially. This timer is enabled after a ports receiver and/or transmitter has been inactive for more than 1 minute. When this timer is operational, it will ignore short noise bursts that could normally cause a system to go active. The length of the noise burst suppression is set by this timer value. Generally you will not want this timer set to more than 1 second (100) for ease in operation. This timer is not designed to stop Port <—> Port “ping-ponging” when connecting two ports to repeaters.

PP = Port Number (Ranges from 01 to 10)

VVV = Key-Up Delay Timer in 10mS increments

Default = 000 mS

Response:

High - High: Initial Key-Up Delay Timer Changed

Long Beep: Error encountered, try again

21 PP VVV*Changes a Port's Half-Duplex Timer (*21 PP VVV) or Configures selected port as Full-Duplex (*21 PP 000):**

This command allows the user to change a ports Half-Duplex Timer. This timer controls the amount of time a ports receiver is not recognized immediately following a transmitter PTT. When the ports transmitter goes from Active to Inactive, this timer is started. When the timer is running, and receiver activity is not recognized. When this timer expires, the ports receiver is now recognized.

The purpose for this timer is to minimize system to system “ping-ponging” that can occur when connecting two repeater systems together. Additionally, if a radios receiver presents a noise burst when it goes from transmit to receive, this noise burst can cause un-needed transmit conditions on its connected ports.

If you experience a condition of radios cycling from transmit to receive and back to transmit..., you need adjust this timer on the port that is causing the un-controlled keying condition. In most cases, this timer is set to less than 2 seconds.

It is important to understand that this timer limits the receiver response time from transmit to receive. While this timer is running, no receiver activity, even intentional reception, will be recognized. So unless your radio connected to a port causes unwanted key-up's, you may want to minimize the length this timer is programmed. You may need to experiment to find an ideal setting for the connected radio.

When operating the port as full-duplex, the user must set the timer as 000. If not, when operating a port as a repeater (See Command *16) the receiver audio will be muted when the transmitter is active.

PP = Port Number (Ranges from 01 to 10)

VVV = Half-Duplex Timer value in 10mS increments

Default = 125 mS

Response:

High - High: Half / Full Duplex Timer Changed

Long Beep: Error encountered, try again

22 PP VVV*Changes a Port's Digital Audio Delay Timer (*22 PP VVV):**

This command allows the user to change a ports Digital Audio Delay length. The Digital Audio Delay introduces a user programmed delay in the transmit audio stream. Radios connecting to systems, like trunking systems, require a small amount of delay as the system accesses an available channel. When the channel is available, the delayed audio is presented which minimizes the "Receiver Clipping" effect which in-turn minimizes lost audio information. The TCB-4 supports a maximum delay of 4 seconds per radio port. Generally the delay amount is set to zero when communicating over conventional radios, and 1.50 seconds when communicating over trunked systems.

PP = Port Number (Ranges from 01 to 10)

VVV = Digital Audio Delay value in 10mS increments

Default = 000 seconds when Conventional Radio Selected

Default = 150 (1.50 seconds) when Trunked Radio Selected

Response:

High - High: Digital Audio Delay Changed

Long Beep: Error encountered, try again

DTMF Command	Description
*30 PP C P	<p>Change the Polarity of the COR & CTCSS input lines (*30 PP C P): This command allows the user to change the polarity of the COR and CTCSS lines available on the radio ports RJ-45 connector. The inputs default as Active Low (requires a 0V or ground as active), but can be programmed to be either polarity.</p> <p>The COR and CTCSS input lines are connected to an optical-isolator to act as a barrier between the TCB and the interfacing equipment. The Cathode of the optical isolator is connected to the RJ-45. The user can either provide an external powering source for the optical isolator or the TCB-4's power input can be used.</p> <p>Note: You must enter both the COR 'C' and CTCSS 'P' parameters for correct execution of this command.</p> <p>PP = Port Number (Ranges from 01 to 10) C = Receivers COR line polarity 0 = Active Low COR line (Default) 1 = Active High COR line P = Receivers CTCSS line polarity 0 = Active Low CTCSS line (Default) 1 = Active High CTCSS line</p> <p>Response: High - High: COR and CTCSS Polarities changed Long Beep: Error encountered, try again</p>

<p>*40 PP E</p>	<p>Enable/Disable Dynamic Telephone Linking using the Telephone Interface Module (TIM): This command allows the user to enable or disable the dynamic linking feature that can be used to connect TCB-4 systems using TIM interfaces using a phone line. See Section 3.3.5.6 for more information about setting up the TIM interface. Also note that the hang up timer must be set before the TIM can be used; this will be done automatically if the TIM DTL (Telephone Interface Module Dynamic Link) personality is loaded.</p> <p>PP = Port Number (Ranges from 01 to 10). Must be a port number on a TIM interface. E = Enable or Disable 0 = Disable Dynamic Telephone Linking for port PP (<i>Default</i>) 0 = Enable Dynamic Telephone Linking for port PP</p> <p>Response: High - Low, High - Low: Disabled Low - High, Low - High: Enabled Long Beep: Error encountered, try again</p>
<p>*41 PP N..N</p>	<p>Set the Dialout Phone Number for Dynamic Telephone Linking: This command allows the user to set the phone number which can be dialed to reach the TIM board in another TCB-4, to set up a Dynamic Telephone Link. See Section 3.3.5.6 for more information.</p> <p>PP = Port Number (Ranges from 01 to 10). Must be a port number on a TIM interface. N..N = The phone number. 30 digits max. Note that some advanced dialing options are available using commas in the phone number. Those options are not accessible when entering this command from a DTMF pad, as there is no comma DTMF digit. See Section 3.3.5.6 for more information.</p> <p>Response: High - High: Phone number changed successfully Long Beep: Error encountered, try again</p>

<p>*42 PP N..N</p>	<p>Set the Security Code for Dynamic Telephone Linking: This command allows the user to set the security code which is exchanged when setting up a Dynamic Telephone Link. See Section 3.3.5.6 for more information.</p> <p>PP = Port Number (Ranges from 01 to 10). Must be a port number on a TIM interface. N..N = The security code. 6 digits max. Note using a longer code will increase slightly the time it takes to establish a Dynamic Telephone Link. See Section 3.3.5.6 for more information.</p> <p>Response: High - High: security code changed successfully Long Beep: Error encountered, try again</p>
<p>*43 PP N..N</p>	<p>Set the Hang Up Code for Dynamic Telephone Linking: This command allows the user to set the hang up code which is exchanged when terminating a Dynamic Telephone Link. See Section 3.3.5.6 for more information.</p> <p>PP = Port Number (Ranges from 01 to 10). Must be a port number on a TIM interface. N..N = The hang up code. 6 digits max.</p> <p>Response: High - High: Hang up code changed successfully Long Beep: Error encountered, try again</p>
<p>*44 PP TT</p>	<p>Set the Hang Up Timer for Dynamic Telephone Linking: This command allows the user to set the length of time (in seconds) after which the Dynamic Telephone Link will be disconnected if there is no activity.. See Section 3.3.5.6 for more information.</p> <p>PP = Port Number (Ranges from 01 to 10). Must be a port number on a TIM interface. TT = The timer duration in seconds. Must be entered as two digits.</p> <p>Response: High - High: Timer duration changed successfully Long Beep: Error encountered, try again</p>

<p>*45 PP TT</p>	<p>Set the Redial Timer for Dynamic Telephone Linking: This command allows the user to set the length of time (in seconds) that the TCB-4 will wait after hanging up before it will check to see if it should dial out again. Two seconds or longer should be sufficient to allow the phone company to detect that the phone call should be terminated. See Section 3.3.5.6 for more information.</p> <p>PP = Port Number (Ranges from 01 to 10). Must be a port number on a TIM interface. TT = The timer duration in seconds. Must be entered as two digits.</p> <p>Response: High - High: Timer duration changed successfully Long Beep: Error encountered, try again</p>
<p>*46 PP</p>	<p>Hang Up a Dynamic Telephone Link: This command allows the user to force a Dynamic Telephone Link to be hung up. If there is more activity, it may redial as soon as the redial timer expires (to avoid that, disable the DTL with command *40). See Section 3.3.5.6 for more information.</p> <p>PP = Port Number (Ranges from 01 to 10). Must be a port number on a TIM interface.</p> <p>Response: High - High, High - Low: A call initiated from this TCB-4 hung up. High - Low, High - High: A call answered by this TCB-4 hung up. High - Low, High - Low: No DTL call was in progress to hang up. Long Beep: Error encountered, try again</p>

TCB System

The TCB system has a set of definitions that will better enable an understanding of its operations. These definitions outline the basic features to enable a user to setup and operate the unit.

Talk Group:

"A collection of multiple radio ports in a group where ones conversation is re-transmitted to all other radios that are members of the talk group"

Port:

"A connection point for an external radio or audio source. For example I will connect the XTS-5000 to a Port on the TCB system"

VOX:

"Voice Operated Transceiver is an acronym associated with the method of detecting the presence of audio, and performing transmitter functions based on the presence of voice. VOX works well when control signals are not available such as a COR signal (explained next). VOX's short comings are when the person speaking delay between words for a period of time and cause the connected transmitter systems to cycle between transmit and receive."

COR:

"Carrier Operated Receiver is an acronym that indicates a receiver has a control line available to indicate when a receiver is active. COR is better than VOX because it does not false inactive with a persons speech patterns. The COR line is a physical line that goes from the inactive state to the active state when the radios receiver detects the presence of a radio signal, not just the presence of audio like VOX does."

PTT:

"Push To Talk is an acronym associated with the action of causing, or keying, a radio into transmit. When told to "key your PTT" indicates you are to cause your radio transmitter to go active. A stuck PTT indicates a transmitter is in the active mode, typically caused by someone sitting on the radios microphone."

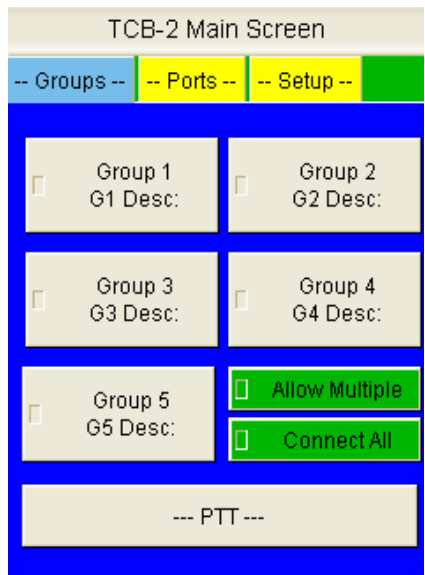
Patching:

"When one port is connected to another port, those ports are "Patched" together, forming a Talk Group. The patching does not need to occur at the same physical location, but only the operation and function determine a patch. When completed, the Talk Group is unpatched or Torn down."

Tactical Communications Bridge System

Setting up a Talk Group and Front Panel Operations

Color LCD and Touch Panel



The TCB-2 and TCB-4 Tactical Bridges come outfitted with a TFT Active Matrix Color LCD display. This display is designed utilizing the light reflective technology which allows the display to be viewable in direct sunlight. For indoor and night-time viewing, a built-in backlight is included. The resolution of the LCD display is 240 pixels wide by 320 pixels tall. The display is fitted with a resistive touch panel to allow field operation of the TCB without the need of a standalone computer.

TCB Color LCD Display with Touch Panel

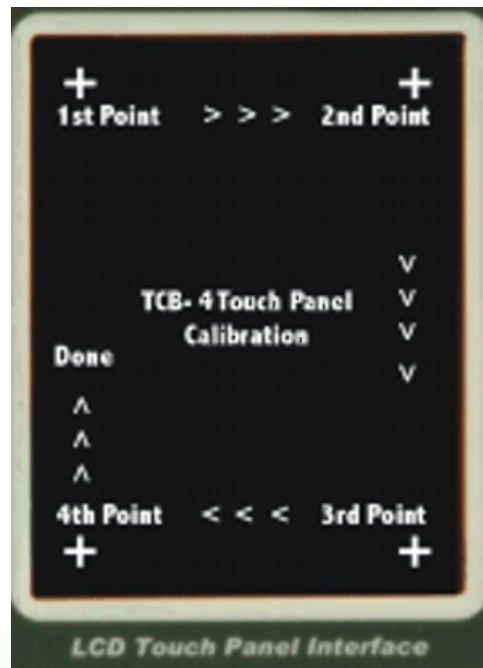
Cleaning the Touch Panel

To extend the life of the LCD's touch panel, a few precautions should be used in its care and operation

- 1) Never use sharp objects to control the touch panel. Damage to the touch panels plastic overlay can occur. For controlling the screen, use either a plastic stylus (included) or your finger.
- 2) Never clean the display with an abrasive material. For cleaning, use a lint free or low lint cloth. Use glass cleaner or lens cleaner. Failure to clean with the correct materials will result in micro-scratches to the touch panels plastic cover. These scratches will not affect the touch panels operation, only the clarity of the LCD's display.
- 3) Never leave the TCB in direct sunlight for extended periods of time. The sun's heat could cause the touch panels accuracy to drift, requiring recalibration (available on startup or from the TCB System Setup menu available from the Operations Setup Screen).
- 4) Never use permanent markers or ink pens as a stylus. These devices can leave permanent marks on the touch panel that can not be removed without damaging the touch panel.

The LCD touch panel can be calibrated to provide the most accurate screen touch operation. The calibration process requires four points to be touched on screen. The TCB takes these four points and calculates a correction factor so your touches line up with the screen's selections.

- 1) Accessing the touch screen's calibration is accomplished either at startup, or from the Operations Setup Screen. You do not need to calibrate the touch panel each time you power on the TCB, the calibration is stored in non-volatile memory so it remembers the calibration each time you power up.
- 2) You should only need to re-calibrate the touch panel if it seems the touch point is not where you expected it to be. If the point is off, simply return to the Operations Setup Screen and hit set-up. There is an option to access "Touch Panel Calibration". Once re-calibration is complete, you can return to your previous operation.
- 3) Care should be taken when calibrating the touch panel, as it affects the overall operation/accuracy of its operation. Try to touch, as close as you can, to the center of the cross. The closer to the center, the more accurate the calibration.



TCB Touch Panel Calibration Screen

- 4) During the Calibration process, only touch the crosses, as any other touches will affect the accuracy of the screen. Touches outside of the area around the crosses will result in a failed calibration, and the screen will revert to the pre-calibration setting for the display.

TCB Operations Screen



1) Group assignment setup is accessed by pressing the desired radio button in the vertical group you want the port located in.

2) Dispatch communicating out individual ports: For dispatching out a port the operator presses the port which communications is desired (located on the left vertical part of the screen). When the PTT is pressed on the dispatches microphone, the selected port will go into transmit.

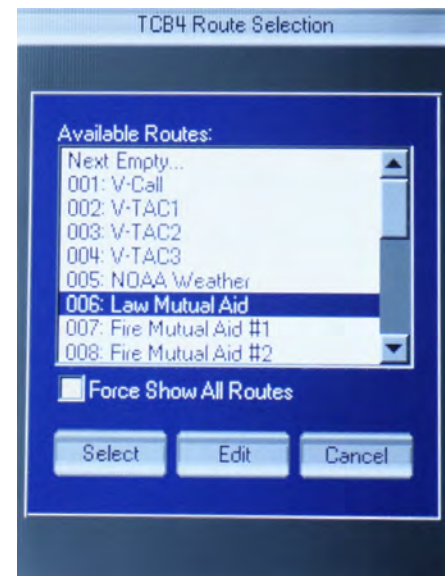
3) Dispatch communicating out selected groups: For dispatching out a group (a set of ports) the operator presses the group which communications is desired (located on the bottom horizontal part of the screen). When the PTT is pressed on the dispatches microphone, the selected group, and all its member ports will go into transmit.

4) Monitoring and selecting ports without affecting the group membership: The Monitor button is provided to allow the dispatch operator to select single/multiple ports without changing the ports group membership. The operator will press the monitor button (which illuminates it) and then press the port(s) which monitoring is desired. When the PTT is pressed on the dispatches microphone, the selected port will go into transmit.

5) Route Selection: A route is a communications path, or frequency on a particular port. If your attached radio can be frequency tuned by the TCB unit, the "R" will show. By pressing the route you can enter the select and setup routine for the radio.



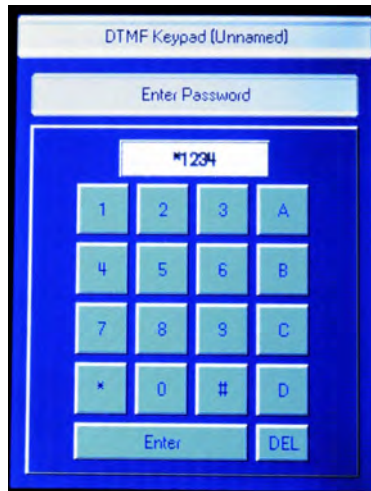
On the first generation TCB units (TCB-2,316,4,406), only frequency information can be stored in a route. On generation two units frequency and IP information can be associated with a route.



Selecting a Route

Configuring a Route

6) System setup: Setup is accessed by pressing the "S" button from the main screen. Setup does not require a password as a default setting.



The password is a five to six digit string that accesses the TCB and effects the LCD and computer access. Once set the password is required, so don't lose it. If lost you will need to contact Link Communications support and may be assessed a charge to restore your system password. The password defaults to *1234.

If the password is enabled you will be prompted to enter it to gain access to the setup portion of the TCB unit.

Password Request Screen

System Setup

Once the password requirements have been entered, the ports/system setup options are provided.

Port setup is the default selected option and it provides access to the setup options for the radio ports.



All setup and configuration changes are accessed from these two screens.

System Setup Tab



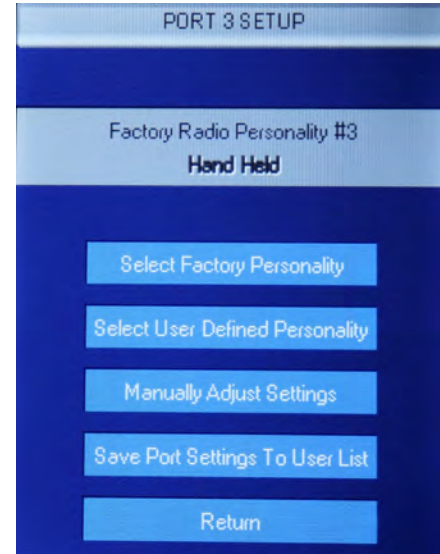
Port Setup Tab

Ports Setup Screen

The TCB-4 allows complete radio adjustment and set-up from the LCD screen. The Port Set-Up Screen allows access to the port specific settings and adjustment. Under normal operations, the radio port set-up screens are not accessed. If accessed, the initial level of features are limited to recalling a radio's personality settings.

A radio personality is a file that contains all the settings for a specific radio model. The personality is available from all radio ports, and greatly simplifies the set-up procedure for the TCB-4. The personality is developed at our main facility, using the actual radio model listed. If the radio you are interfacing is not listed, then start with the Generic Handheld or Generic Mobile settings.

Selected Port Setup Screen



Select Factory Personality

Recalls pre-programmed radio settings that are included as tested radio setting. Factory personalities can not be changed or edited. Any changes made to the factory settings will be stored under a User Defined Personality.

Select User Defined Personality

Recalls user defined radio personality. The user defined personality list contains custom radio personalities. For example, if a factory personality is recalled and then edited, you would store the result in the user list.

Manually Adjust Settings

Once a personality is recalled, you can make changes to the recalled settings. Once changes are made, you can store the results as a User Defined Personality.

Save Port Settings To User List

Once recalled settings have been changed, you need to save the settings. The User list is provided for this purpose.

Return

Exits Port Setup and returns to the Operations Setup Screen.

Port Set-up Screen: Select Factory Personality

Pressing the Select Factory Personality button will take you to a screen that allows you to select a radio from the Radio Personality List. The radios listed have been factory tested to ensure their quality. If your radio is not listed, then select between either the Handheld personality or the Mobile personality. These two generic personalities will fit many of the radios on the market today.



Factory Personality Screen

Port 1 defaults to **Console** indicating the Console Interface system is installed. When choosing Console for Port 1, the Groups tab and the Ports tab will be enabled. Once enabled, the user can navigate and control the front speaker through this button.

Ports 2 through Ports 10 default to the generic Hand Held personality.

The Hand Held personality is defined as follows:

- Transmitter Audio set to
 - Microphone range
 - Level set to 50%
- VOX receiver access enabled
 - VOX speed set to Medium
 - VOX sensitivity set to 50%
- Transmit audio delay set to 0 seconds

Once you have selected the personality to use, press the Select button. This will assign the selected personality to the radio port. Once selected, the display will return to the Port Set-up screen. If no changes are needed to the recalled personality, press the Return Button to accept the changes.

Pressing the Select User Defined Personality button will take you to a screen that allows you to select a radio from the User Personality List, if any exist. Any Factory personalities that have been edited can be added to this list. Once the edited personality has been stored, the User name displayed matches the radio name under the Manually edited screen (See next page). Any port can access the User radio list, so any changes that are made will be available for any other ports on the TCB-4. The TCB-4 supports a total of 15 User Personality slots, and these slots are available from all ports on the Tactical Bridge.

Special Considerations:

- Name each User Personality uniquely. This will minimize any confusion between a factory and a user personality.
- When a port recalls a User Personality, the settings from the personality are transferred to the port.
- Manually adjusted settings only changes the settings for that port, not the personality that you recalled as a starting point.

Port Set-up Screen: Manually Editing a Personality

Pressing the **Manually Adjust Settings** button will allow changes to be made to a Factory or User Defined Personality. Once the changes have been made, the user can either store the changes in one of the fifteen User Personality slots, or simply exit the Manual Settings utility and return to Operations.

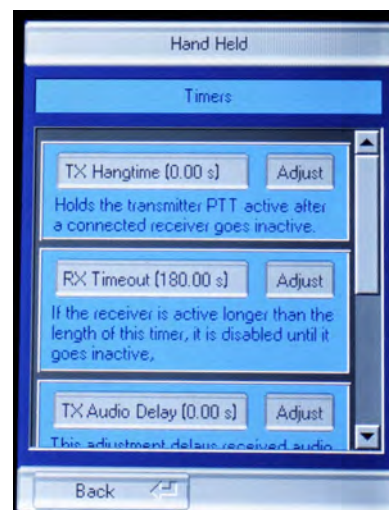
Changes made, but not saved to a User Slot are permanently stored until a System Initialization (See System Setup) is requested. At this time the settings will be lost because they have not been stored to the User List.



Audio Adjustments



Access Conditions



Timer Adjustment

Adjusting Audio Settings, Screen 1:

- **Receive Level:** Range from 0 to 100%. When Automatic Gain Control (AGC) is enabled, the Receiver Level is automatically adjusted, therefore this setting is not used.
- **Receiver AGC:** The AGC setting is always ON. The user can not currently disable the AGC level adjustment.
- **Transmit Level:** Range from 0 to 100%. This adjustment controls the transmitter deviation. Correct setting of this adjustment requires a transmitter deviation meter. Adjust this setting to meet the deviation requirements of your transmitter.
- **Line Level:** This check box allows the user to determine what load the TCB-4 is driving. When driving microwave, E&M and mobile radios, this setting is usually checked. The TCB-4 is capable of driving +10dBm into 600 Ω loads when checked.
- **Microphone Level:** This check box allows the user to determine what load the TCB-4 is driving. When driving handhelds, and very sensitive audio circuits, this setting is usually checked. The TCB-4 is capable of driving -20dBm into 600 Ω loads when checked.
- **Tone Level:** This adjustment is used to control the level of the regenerated tones used for responses and generic signaling. The tone level amount is considered as a percentage amount compared to all other modulation sources. The transmitter level adjustment also affects the tone level. This level defaults to 50%.



Audio Adjustments

Radio Type: This setting determines what type of special radio is connected to the system. There are three selections available.

- **Not controllable:** Choose this selection when attaching a non-Tait radio to the TCB
- **Tait Radio:** Choose this selection when a Tait TM-8115 or Tait TM-9155 series radio is used. The Tait radio enables frequency control of the radio through the software on the TCB, removing the need for additional Radio Service Software in the field. Currently Link only controls the Tait series of radios.
- **EIA Tone Controlled:** Select this box if you have attached an EIA tone controlled radio, or want to send EIA tones out the radio. Aftermarket interfaces can attach to some radios and enable channel control of the attached radio. Some 4-wire attachments also use this feature for remote base operation of a remote radio.

Access Conditions Screen:

● Receiver Access Conditions:

This section allows the user to customize the conditions that must be met in order for the TCB-4 to recognize an active receiver state.

COR Line and CTCSS Line:

These signals are available on the RJ-45 connector. When connecting to them, the receiver will activate from the radio's squelch circuit, and not the radio's received audio. The COR line is connected to the radio's squelch or busy indicator and the CTCSS line is connected to an external CTCSS and/or DCS decoder.

Invert:

The Invert check box allows the external COR/CTCSS signal to be treated as Active Low/High. When checked, the input is treated as Active High. When not checked, the signal is treated as Active Low.

If no COR or CTCSS is connected, then do not check the COR/CTCSS buttons.

VOX:

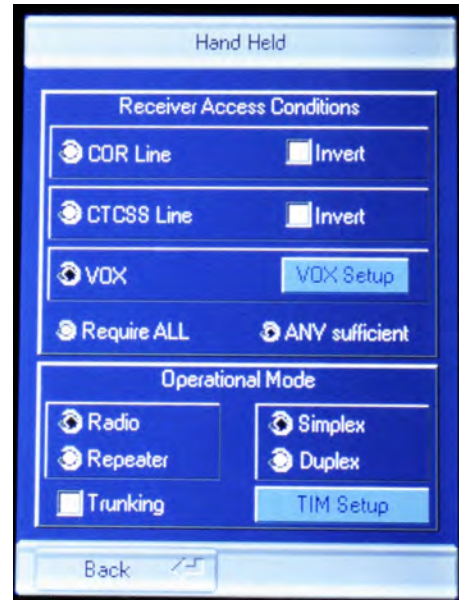
The VOX selection provides a receiver active indication based on the radio's voice content. The DSP looks for voice content and based on this, the receiver will activate. In order for the receiver to remain active during typical word pauses during a conversation, the TCB-4 has three selectable VOX times, slow, medium and fast.

VOX Setup Button:

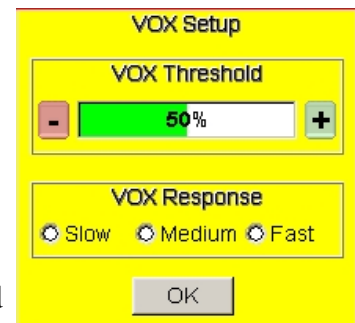
If during the operation, the TCB-4 drops from receive easily, you may need to slow the reaction time of the VOX. Slow VOX setting will wait longer between words. If a high noise floor due to weak signal, or background noise, the VOX Set-up provides a VOX Threshold setting. When experiencing voice or noise falsing, increase the VOX Threshold setting. This will make the VOX less sensitive.

Require ALL and ANY sufficient

These two selections allow the user to determine what condition(s) must be met to activate the TCB-4. Require ALL indicates that all selections must be active before the system treats the receiver as active. ANY indicates that any of the selected conditions may be active for the TCB-4 to recognize the receiver as active. If only one condition is selected, ANY and ALL work the same way.



Access Conditions Screen



VOX Setup Screen

- **Operational Mode**

The next section is the radio port Operational Mode. When connecting a radio or audio source to the TCB-4, you will need to define the type of unit being connected. This will allow the TCB-4 to operate connected device more efficiently.

Radio:

On the TCB-4, a radio is defined as a device, other than a repeater. When the receiver goes active on a radio device, its audio is intended for other connected devices (either Radios or Repeaters). A radio device's transmitter is intended to carry other ports receiver's information, but not its own. Handhelds, mobile radios, and microwave ports are defined as radio devices.

Repeater:

On the TCB-4, a repeater is defined as a device that repeats information that comes in on its own receiver. When the receiver goes active on a repeater device, its audio is intended for other connected devices (either Radio's or Repeaters) along with its own transmitter. A repeater is designed to extend the coverage of the information received on its receiver.

Half-Duplex:

A half-duplex device's receiver or transmitter can operate, but not at the same time. A handheld radio is typically half-duplex. When in transmit, the receiver is turned off. When in receive, the transmitter is turned off. They both can not simultaneously operate.

Full-Duplex:

A full-duplex device's receiver and transmitter can operate independently of each other. When the receiver goes active, its transmitter, on the same ports, can also be active. Precautions must be taken to keep the port's transmitter from interfering with the port's receiver. This is accomplished utilizing both frequency separation and either separate antennas or a duplexer. When a port is both a radio and full-duplex, the receiver is always available for operation and control. Your cell phone is full-duplex. You can hear a conversation, and talk at the same time.

-

Trunking or Conventional Radio

When connecting a Trunked radio to the TCB-4, the Trunking box should be checked. This simply automatically enables the Digital Audio Delay and sets it to 1.50 seconds. This will allow a radio to access the trunked channel without losing any audio. The Audio Delay is adjusted at Adjustment Screen #3.

- **TIM Setup**

If the port that is selected for set up is on a Telephone Interface Module (TIM), you can access a setup screen for it using the "TIM Setup" in the lower-right corner of the screen. See Section 3.3.5.6 for more information about setting up the TIM interface.

Timer Adjustment Screen:

- Port Specific Timers**

some basic operational timing parameters. The timers control receiver access times, transmitter hang times and Digital Audio Delay amounts.

Transmitter Hang Time:

This button allows the user to change a Port's Hang Timer. This timer controls how long the ports transmitter stays keyed after the connected receiver (s) go inactive. The timer defaults to 0.00 seconds.

Receiver Time-Out Time:

This button allows the user to change a Port's Receiver Time-Out timer. This timer controls the maximum time a receiver can be active before the TCB no longer recognizes the receiver. This is useful to limit a persons talking time that can tie-up operation on the TCB. This timer defaults to 60 seconds.

Audio Delay Time:

This button allows the user to change a port's Digital Audio Delay length. The Digital Audio Delay introduces a user programmed delay in the transmit audio stream. Radios connecting to systems, like trunking systems, require a small amount of delay as the system accesses an available channel. When the channel is available, the delayed audio is presented which minimizes the "Receiver Clipping" effect which in-turn minimizes lost audio information. The TCB supports a maximum delay of five seconds per radio port. Generally the delay amount is set to zero when communicating over conventional radios, and 1.50 seconds when communicating over trunked systems.

Initial Delay Time:

This button allows the user to change a ports Initial Key-Up Delay timer. This timer controls the amount of time a port's receiver is not recognized when it goes active initially. This timer is enabled after a port's receiver and/or transmitter has been inactive for more than 1 minute. When this timer is operational, it will ignore short noise bursts that could normally cause a system to go active. The length of the noise burst suppression is set by this timer value. Generally you will not want this timer set to more than 1 second (100) for ease in operation. This timer is not designed to stop Port - to - Port "ping-ponging" when connecting two ports to repeaters (see the HalfDuplex Delay Timer for that).



Adjustment Screen 3

Half-Duplex Delay Time:

This button allows the user to change a port's Half-Duplex Timer. This timer controls the amount of time a port's receiver is not recognized immediately following a transmitter PTT. When the port's transmitter goes from Active to Inactive, this timer is started. When the timer is running, any receiver activity is not recognized. When this timer expires, the port's receiver is recognized again.

The purpose for this timer is to minimize system to system "ping-ponging" that can occur when connecting two radio systems together. Additionally, if a radio's receiver presents a noise burst when it goes from transmit to receive, this noise burst can cause unneeded transmit conditions on its connected ports.

If you experience a condition of radios cycling from transmit to receive and back to transmit, you need adjust this timer on the port that is causing the un-controlled keying condition. In most cases, this timer is set to less than 2 seconds.

To locate the receiver causing the ping-pong condition, select the Setup tab and select the group that is causing the cycling condition. Look for the port that only is active in receive for a very short period (usually less than 1 second). Once the port causing the problem is located, you will need to increase the Half-Duplex timer for that port.

This is accomplished by the following steps:

- Enter Port Setup mode

Return to the Setup screen and press the port number button which is causing the cycling

- Press the Half-Duplex adjustment timer to make the changes.

This screen is the first screen you encounter when entering the port setup mode

It is important to understand that this timer limits the receiver response time from transmit to receive. While this timer is running, no receiver activity, even intentional reception, will be recognized. So unless your radio connected to a port causes unwanted key-up's, you may want to minimize the length this timer is programmed. You may need to experiment to find an ideal setting for the connected radio.

When operating the port as full-duplex, the user must set the timer as 000. If not, when operating a port as a repeater (See Command *16) the receiver audio will be muted when the transmitter is active.

Port Set-up Screen: Storing an Edited Personality

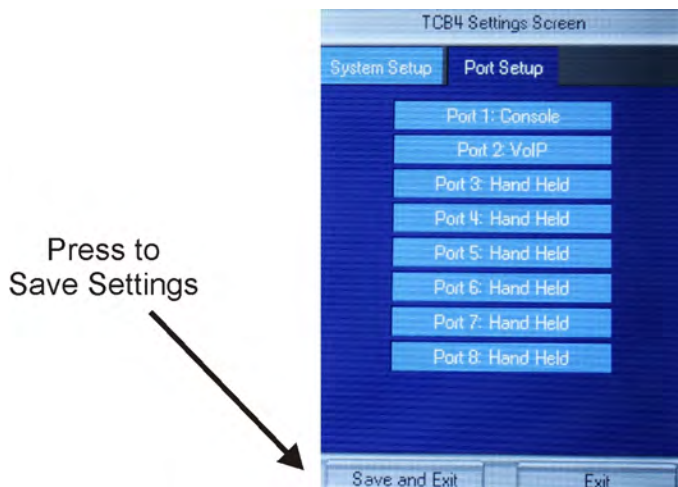
Once all changes have been made to the Radio Personality, you will need to save the changes. The User List provides 15 storage slots for saving your changes. A User slot is accessible from all Ports, utilizing the “Select User Defined Personality” selection. Pressing this button takes you to the User Storage list. To Store a User Personality, select a slot number, and press the Select Button. This will store the information which was Manually edited.



To exit User Personality Storage, press the Cancel button. This will return you to the Port Set-Up screen without saving the current settings to a slot.

User Personality Screen

Saving Setting once completed:



Once all changes have been made to the system you will need to save them. All settings are stored in the TCB's FLASH memory assuring any power interruption will not loose the changes that have been completed.

Returning back to the initial Setup screen, in the lower left corner is the save button. Pressing this will write the changes for use later. Pressing the Exit button will exit w/o saving. Be forewarned that power interruptions will cause unsaved settings to be lost.

Graphical User Interface

The TCB-4 supports a flexible Remote Control software package that runs on computer running Windows[™] 2000, NT, XP and Vista. This software package enables the user the ability to remotely program, set-up and operate the TCB utilizing either the RS-232 port or the Ethernet interface. The GUI software is set-up in a dispatch operating style with a main operating screen that enables the user easy access to the radio talk groups and individual radio ports. The user can manipulate the talk groups with either a touch screen, mouse clicks or keyboard commands. When changes are required for the radio ports, the user can click (right mouse button+click) on the radio port to access the ports set-up features. Clicking on a radio port enables communications out the selected port, while clicking and dragging the radio port into a talk group enables manipulation of the group.

When utilizing Voice over Network (VON or VOIP) technology, the user can receive audio and send audio to the TCB remotely enabling a complete remote operated solution.



Remote Control Interface: Grid View Dispatch Screen



Saved Connections

Group Sets

Tree View

Screen and display options located on the left and right sides of the screen

Grid View

Classic View



TCB Remote Control Interface

Step 1: Download the latest firmware for your TCB unit.

Visit: www.link-comm.com/security

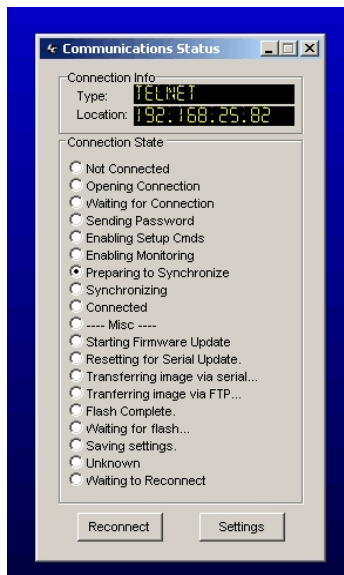
Select the TCB unit you have and press the "Support" link on the right side of the screen.

You can now access the firmware, manuals and GUI software for your unit.

Getting Started

The TCB Remote Control Interface (TCB Console) is an alternate way to control the TCB. The remote control interface runs on a standard PC, which allows for easier setup due to a larger screen size and allows control of the unit from a remote location. A few of the basic features of the TCB Remote Control Interface are covered in the following pages.

- Download and install the latest version of the TCB Remote Control Interface.
- The TCB Remote Control Interface installs to "C:\Program Files\TCB4\Remote\" by default.
- The TCB RCI will automatically try to connect to a TCB using the settings that were entered the last time the program was run. If these settings still refer to a TCB that can accept a connection, then the TCB RCI program will connect and then synchronize itself with that TCB.
- Notice that the Status Bar at the bottom of the screen shows that the TCB RCI is "Connected to a TCB unit at IP address 192.168.25.82."



RCI utilizes two methods for connecting to the TCB unit.

Serial:

A valid COM port must be entered to connect with

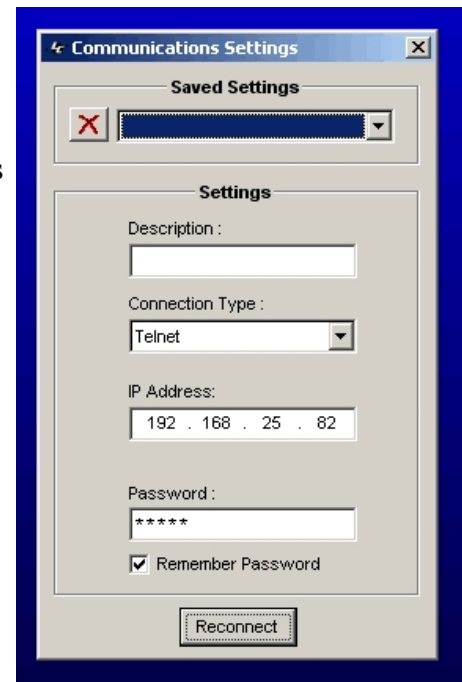
Telnet:

The units IP address

A valid password is necessary (*1234 by default) and one of the above connection methods before the computer and the TCB are in sync.

Watching the Connection Status display will show the progress of the connection. If the Waiting for Connection and Opening Connection seem locked in an endless loop, the TCB is failing to connect. Check your communications settings (see next page).

- Once the TCB RCI is finished synchronizing itself with a TCB, you will notice that Port/Group names are now valid.
- You can choose an alternate way to connect with your TCB. Each TCB unit can support 1 serial connection and up to four simultaneous telnet connections.
- Each connection can have its own unique settings. Saved Settings can contain the list of different TCB's of the same type you are managing with RCI.
- Connection issues are usually associated with the wrong password or an incorrect IP address. To verify password try connecting with Serial and see if the connection is successful.



Operating the RCI GUI Interface

The operations of the Windows (TM) RCI program is similar to the LCD display version. The main operating screen contains the groups and port assignments and the setup screens contain specific port setup details.



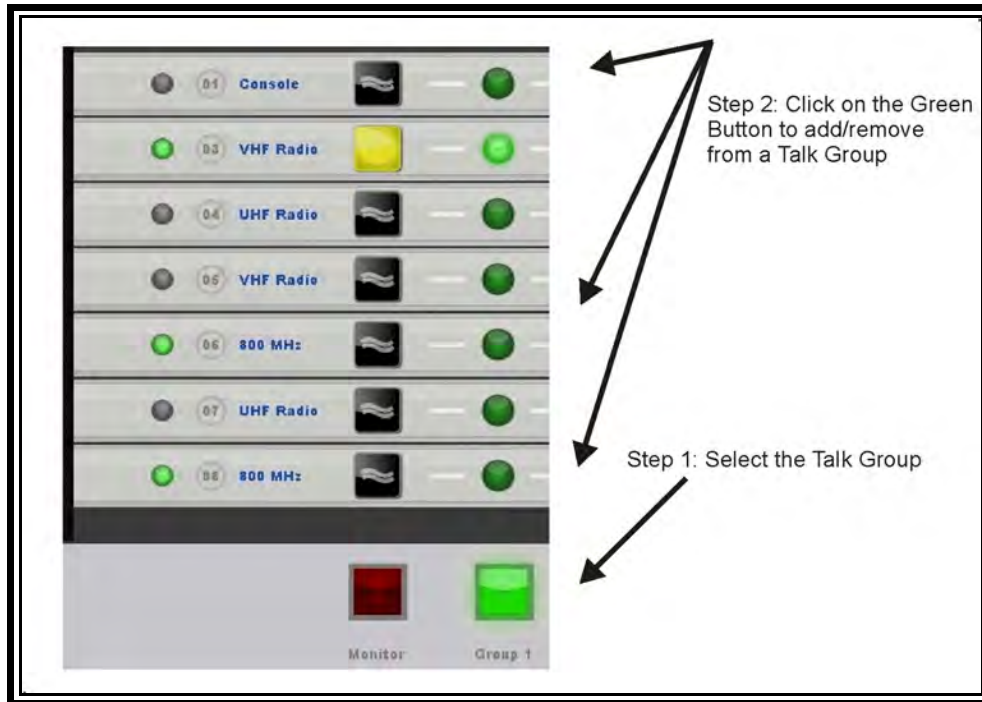
Radio Slice from RCI

The following discussion will describe the difference between the earlier discussed LCD and the RCI version. More descriptions follow below. **Port Setup:** Port setup is accessed by <Right Clicking> with your mouse on the name of the port (for example: Hand Held). This will take you to the settings screens.

Route Selection: Route selection is accessed by clicking on the lit LCD display (located on the right of the radio module). Right clicking on the selected route will pull-up the setup screens.

Modifying Talk Groups

In review, a talk group is a group of radio ports that when active, communicate to all the other ports in the talk group.



To build a talk group:

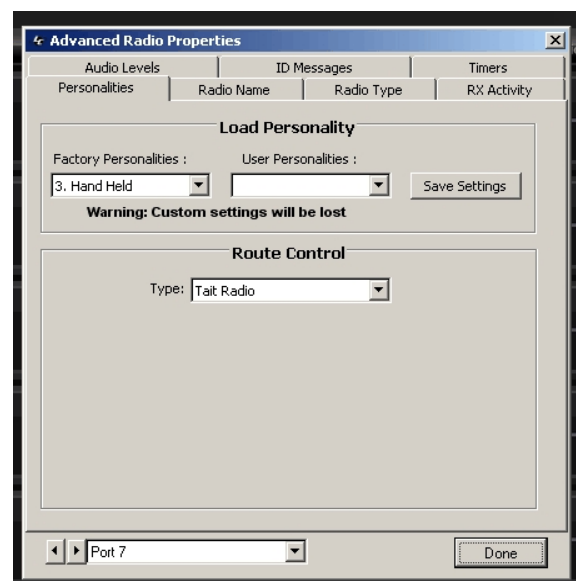
1) Select the talk group you wish to modify

2) Press the round green button to either add or remove the port from the group

2-Tone Paging

If your system contains frequency controllable Tait radios you can utilize the Paging feature of the TCB system. The TCB supports 2-tone analog paging tones that can be transmitted out selected ports. The method that enables this feature is as follows:

- Select Tait Radio under the Personalities Tab
- Click the “Done” button to return to the main RCI operations screen



- Select the Route you want to assign the 2-Tone sequence in.
- Click on the “Channel” or “Direct Frequency” bullet and proceed to the Paging section of the form

- Click the “New Page” button to set-up a new page sequence. Each pager manufacture is different so refer to the pager you have to determine the correct tone frequency/duration for the page.

- Enter the tone information for the page

New Page

Two-Tone Page Settings:

	Frequency (Hz)	Duration (seconds)	Delay After This Tone (Seconds)
Tone 1	563	1	0
Tone 2	908	3	

Settings That Affect All Pages:

After send page, keep transmitters keyed for this long (seconds): 2.0

Buttons: Done, Cancel

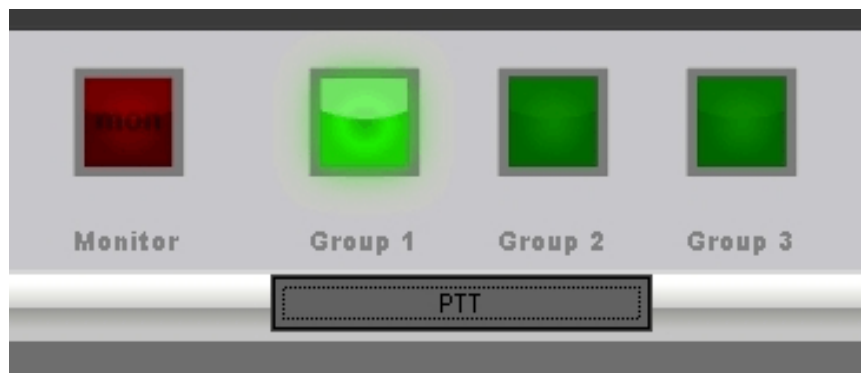
Route Selection

Active Radio Port: 07:Hand

#	Name
5	NOAA Weather
26	IR11
39	Fire Test
41	test

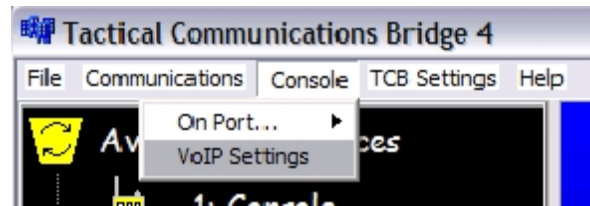
Paging Control Screen

- Once the page is entered click the “Done” button to accept the changes. When returning to the RCI Operations Screen, the PTT button will change when a page is assigned to frequency route. The user will click on the Page portion of the PTT bar to send a Page.



Remote Console Operation (VOIP)

The TCB-4 has integrated VoIP support from the TCB to the RCI console. To enable the VoIP features clips the "Console" selection and select VoIP settings. When you are done entering your settings, click "Done" to exit back to the normal program screen.



VoIPForm

☒ **Enable VoIP Streaming**

VoIP Settings

Network Settings

☒ **Connect via LAN (IP address determined automatically)**
Use this option if the unit is on the same LAN (local area network) as your computer.

☐ **Connect through a firewall**
Use this option if the unit is not on the same local area network as your computer, such as if you are connecting to it over the Internet. In this case, the unit will need to know the address of the firewall between your computer and the Internet to be able to send VoIP audio to you. You may be able to find your firewall's IP address by clicking the "Get Public IP Address" button.

Firewall Address :

Latency Adjustments

VoIP Out Latency

VoIP In Latency

Connection Statistics

Counters

Underflow	2	Lock	0
Overflow	0	Fragment	0
Encroach	0	Address	0

Cursors

Current	0
Last	0
Fill	0

Streaming...

- The setup form enables the setup of the IP information, and if a firewall is utilized on external Internet access.

- The TCB utilizes Port 23000 on the IP router for passing VoIP information. Your IT person needs to open up this port for UDP data to pass through if utilizing the VoIP outside your local IntraNet. Local network usage does not require any firewall changes.
- Now you should be able to get remote console operation utilizing your sound card's microphone/speaker interface. You will have full audio between the TCB-4 and the computer console once the VoIP is enabled.
- A maximum of four simultaneous VoIP connections are supported. Audio is accepted from the unit that has the PTT bar active. The TCB-4's receiver audio is routed to all connected computers (with a maximum of four active connections).
- You can monitor any group or port by simply clicking on the Port/Group button or tree icon. Notice that when you click on a talk group, all the port members of that group are highlighted. This means that remote console is now monitoring these ports.
- When you want to transmit over a selected port/group, click the PTT button. The PTT button will turn red when successfully activating the remote console's ptt. If the PTT button doesn't turn red, then there is a connection problem. Make sure your telnet connection is still alive. Notice that the radios that are in transmit now have red icons on the port buttons. Also notice the green button...this is the remote console port that contains the VoIP information. The local TCB console is located on Port 1 and the VoIP remote console (RCI's console) is on Port 2.

Adjusting the TCB

There are a couple of timers that need to be understood on the TCB system. These timers are important in suppressing noise and interference that can occur when your TCB is located at a deployment. It is good to understand the terminology associated with each timer enabling a qualified person to adjust the timers, if needed, to suppress any radio interference issues.

Remember it is better to remove the interference than just suppress it. Suppressing it covers it up, but the effects to the quality of the deployment will be determined by the level and the amount of the interference.

The three terms to understand are:

Half Duplex Timer (Ping-Pong'ing):

"No it is not the game, but a real world problem associated with Interoperability. When tying two repeaters together, activity from one repeater can cause the other repeater to cycle. This cycling will keep both repeaters from performing correctly and will need to be eventually disconnected by tearing the patch between the two down."

Initial Delay Timer:

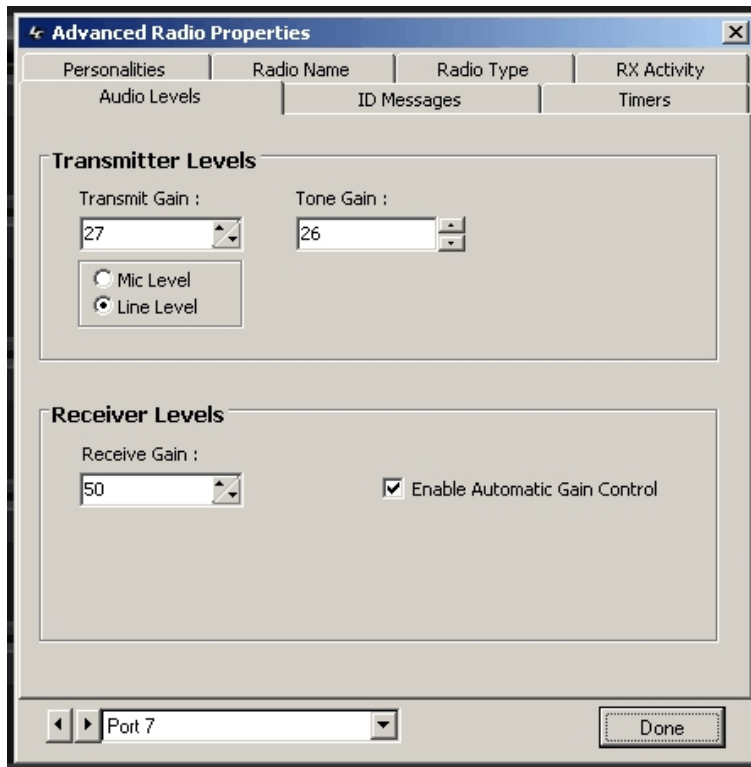
"When interference with a repetitive pattern occurs that causes the system to cycle on then off. The pattern can be suppressed which covers up its potential to interfere, but does not cover up the interference."

Time-Out Timer:

"A feature used to limit the length of a transmission. The timer-out timer enables automatic control of a transmitter by shutting it off if the length of time between receive and transmit exceeds the systems timer length. Typically this timer is set to 60 seconds or less. The timer can be defeated by setting it to 0 seconds."

Changing Settings

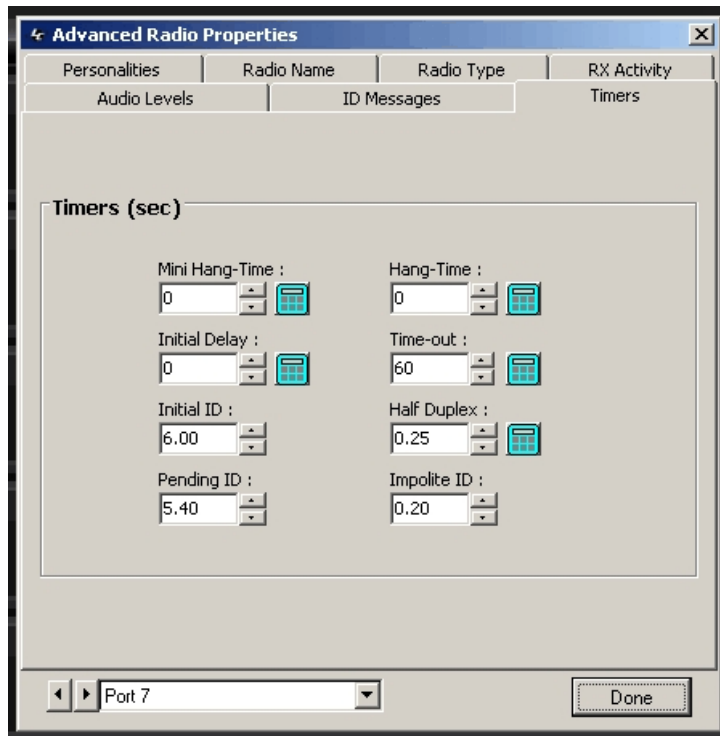
- You can use either the front touch panel display or the Remote Control Interface to access and change system, port, and group settings. Changes are reflected only if the requested change was successfully accepted by the TCB unit. If you make a change and it doesn't show up, then you probably have a connection problem. You might need to reconnect your telnet session.
- You can access the port settings by right clicking the mouse as its name.
- All other adjustments other than the two described above do not need to be adjusted without the supervision of a radio technician. These settings control the connected radios audio levels and access modes.



Audio Levels Tab

Definitions:

- Transmit Gain: A number from 0 to 100 that sets the necessary transmit audio level for the selected ports audio output.
- Mic Level or Line Level: The TCB can drive either low level devices (such as handheld radios) or high level devices (such as mobile radios or E&M signaling devices).
- Tone Gain: This setting determines the level of the tones generated by the TCB. The tone level is adjusted separately from the receiver audio level. The transmit level is an over all level adjustment which includes the overall tone level.

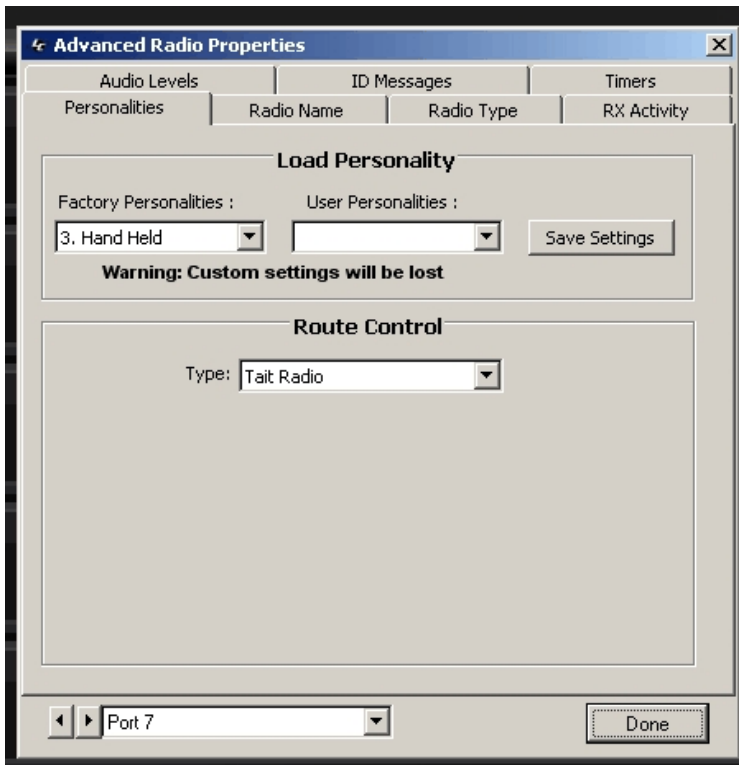


Timers Settings Tab

Definitions:

- Mini Hang-Time: Hang timer used to hold the transmitter active between messages. Typically set to zero
- Hang-Time: Main transmitter hang-timer for holding the transmitter active after a key-up.
- Initial Delay: Length the initial signal needs to be active before the TCB recognizes it. Once active the signal must be absent for 60 seconds before the timer is re-armed
- Time-out: This timer is a receiver based timer that limits the length of the receiver before the TCB shuts it off. The carrier must go inactive before its receiver is recognized.

- Initial ID: This timer is only used when the transmitter ID system is enabled. When utilized the timer determines how long a receiver must be inactive before recalling the Initial ID message.
- Half-Duplex: The time after a PTT goes from active to inactive before the receiver is enabled. This timer is used to fix the issues with ping-ponging.
- Pending ID: This timer is only used when the transmitter ID system is enabled. When utilized the timer determines how long a receiver must be inactive before recalling the Pending ID message. The timer needs to be shorter than the Initial ID timer in order to utilize the Pending ID message.
- Impolite ID: This timer is only used when the transmitter ID system is enabled. When utilized the timer determines how long the TCB waits when an ID is requested (either the Initial ID timer or the Pending ID timer has expired), before sending the Impolite ID message. Typically set for 20 to 30 seconds.



Radio Personalities Tab

Definitions:

- **Factory Personalities:** The factory defined radio settings levels for specific connected radios. If your radio is not in the list, and a radio near your radio type is not listed then start with a generic profile.

When connecting a handheld radio for the first time, select Hand Held. When connecting a Mobile select the Mobile personality.

- **User Personalities:** Once a personality has been edited, you need to save it to one of the User Personality positions. Once saved you can recall it by selecting it from the User list.

- **Route Control:** If your connected radio is capable of controlling the radio's frequency and/or channels you need to select it from the Route Control list. If the radio is Not Controllable then choose this setting. If controllable, select the appropriate radio which in turn enables the Route Control Selection on the Main Screen.



Advanced Radio Properties

Audio Levels | ID Messages | Timers

Personalities | **Radio Name** | Radio Type | RX Activity

Radio Name :

Hand Held

Radio Description :

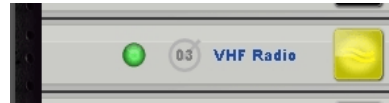
Port 7

Port 7

Done

Definitions:

- Radio Name: The name used to identify the radio displayed from RCI. The name is limited to 9 characters.



- Radio Description: This information is not displayed but can be used to store specific information about the radio, its uses, serial number or anything you want to type here.

Radio Name Tab

Advanced Radio Properties

Audio Levels | ID Messages | Timers

Personalities | Radio Name | **Radio Type** | RX Activity

Type

☒ Link / Remote Base ☐ Repeater

Link Port Settings

☐ Full-Duplex

☒ Half-Duplex (TX has priority) Time (sec): 0.25

☐ Half-Duplex (RX has priority)

PTT Control

☒ PTT Enabled ☐ PTT Disabled ☐ E+M PTT Loop

Audio Delay

TX Audio Delay (sec): 0

Port 7

Done

Definitions:

- Type: Identifies the type of radio connected to the port. Only select a repeater when one is actually connected otherwise it will operate differently than a normal radio. A repeater provides PTT when the receiver goes active on the same port. A full-duplex radio is required for repeater operation.

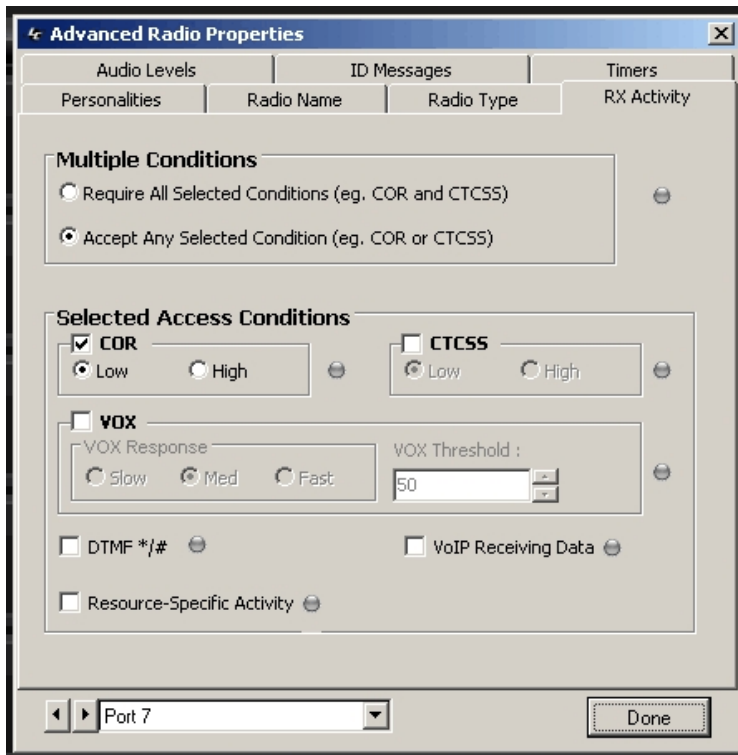
- Link Port Settings: Normally Half-Duplex is selected unless a full-duplex base or repeater radio is used.

-Time (sec): The time that the controller waits when in half-duplex mode

Radio Type Tab

- PTT Control: You can enable and disable a port's PTT with this control. If operating an E&M interface then select E&M PTT Loop.

- Audio Delay: This value delays the transmitter audio for up to 5 seconds, per port. The delay is generally utilized on trunked radio systems. The default audio delay is 0 sec.



Definitions:

- **Multiple Conditions:** This setting determines what conditions need to be met before the receiver is either active or inactive. Require All indicates that the selected access modes (COR or CTCSS or VOX) must be active before the receiver active condition is met. This is an AND function.

Accept Any requires that any of the checked conditions are active before the receiver is active. This is an OR function.

RX Activity / Status Tab

Selected Access Conditions:

- **COR :** Carrier Operates Receiver line must be active to indicate an active receiver. This is pin 2 on the RJ-45 connector and is connected to a +12V referenced Optical Isolator. The users equipment must be able to handle +12V to interface safely to this line.

- **Low:** Active Low means the line must go to ground when active. When active the “bubble” next to the High condition will be Red.

- **High:** Active High means the line must go to +12V or Open when active. When active the “bubble” next to the High condition will be Red.

- **CTCSS:** Continuous Tone Coded Squelch System, pin 3 on the RJ-45 (see COR above)

- **VOX:** Voice Operated Xceiver indicates the receiver is operated based on the presence of audio. VOX is used when a COR or CTCSS line is not available. The user must play with the settings to best match the radios audio. Slow means the voice inflections are slower, and the controller will wait longer between pauses in the voice before treating the receiver as inactive. Medium is faster and Fast is the fastest.

VOX threshold is the sensitivity of the DSP in detecting the presence of audio. As the number gets smaller, the sensitivity increases. The higher the number the less sensitive the VOX system is.

- DTMF */#: This function will not recognize an active receiver unless a DTMF '*' is sent by the user, then the receiver is active. To cause the receiver to go inactive the user sends a DTMF '#' character. This mode is generally used by telephone access to the controller where a COR line is not available, and the user does not wish to have the ring tones sent out the connected radio ports.
- VoIP Receiving Data: This setting is utilized when a virtual VoIP port is used. The controller determines the VoIP stream is active when the controller receives streaming data. When the data stops streaming the VoIP is treated as inactive. This feature is only utilized with VoIP configured ports.
- Resource Specific Activity: This access mode is designed for certain interfaces where a hybrid (analog audio and digital control signals) are used. For example, an MSAT-G2 satellite radio interface is considered a hybrid interface. The controller watches the MSAT data stream to see if it is active before treating the receiver as active, and a different code in the data stream for inactivity. Only specified interfaces (such as the MSAT-G2) utilize this form of activity.

Saving your changes:

Once all setup and changes are made, it is very important to save the changes to the TCB's FLASH file system. This is accomplished by clicking on the File selection and the "Save Settings on the TCB-#". When saving, communications to the TCB is interrupted, so be sure to take this into account when saving the settings. Once the saving process is completed, RCI will return to its normal operation mode.

Contact Information:

If you have any questions not answered by this short tutorial, feel free to contact us:

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1035 Cerise Road Billings, MT 59101
Voice: (406)245-5002
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Email: info@link-comm.com

Appendix A

Disabling the Console Interface

The console interface system allows the user to locally control, organize, dispatch and monitor a situation utilizing this built-in feature on the TCB-4. However it does take one of the available radio ports (Port 1) to provide this function. There may be a time where you will need to disable the console interface feature if the TCB-4 is remotely installed and/or port 1 is needed for deployment. When the Console Interface is disabled, monitoring and control from the front-panel console interface will no longer be possible.

There are two steps needed when disabling the Console Interface.

- Step 1: Software must de-select the console feature for Port 1
- Step 2: Hardware must be disconnected inside the TCB-4

Software disabling:

To disable the Console Interface option on the TCB-4, select "Port 1" from the Operations Setup Screen and press "Setup". Once in set-up you will be prompted to select a Radio Personality for the set-up list. When the Radio Personality is selected for anything other than the "Console "Interface", the software side of the interface is deselected. Once you exit and return to the Operations Setup Screen, you will notice that the Console Group button is no longer selected, and is greyed out.

Hardware disabling:

To disable the Console Interface hardware, you will need to remove the lid of the TCB-4, and unplug a 10 pin ribbon cable that is feeding the front panel console connector board.

Before removing the lid on the TCB-4, unplug the +12VDC power input.

Step 1: Removing the lid of the TCB-4. Tools Required: Medium tip Philips Screwdriver.

Remove the plastic bezel from the front and rear of the TCB-4. This is accomplished by gently prying the middle of the bezel, on either the left or right side of the bezel. Gently pry one side of the bezel and the assembly will easily come off. Do this procedure on both the front and rear of the TCB-4.

Step 2: Removing the lid. There are two screws in the upper left and right corner of the TCB-4. These screws are hidden from view when the bezel is attached. You will be removing a total of (4) screws (two from the front and two from the rear). Set these aside for the re-assembly task.

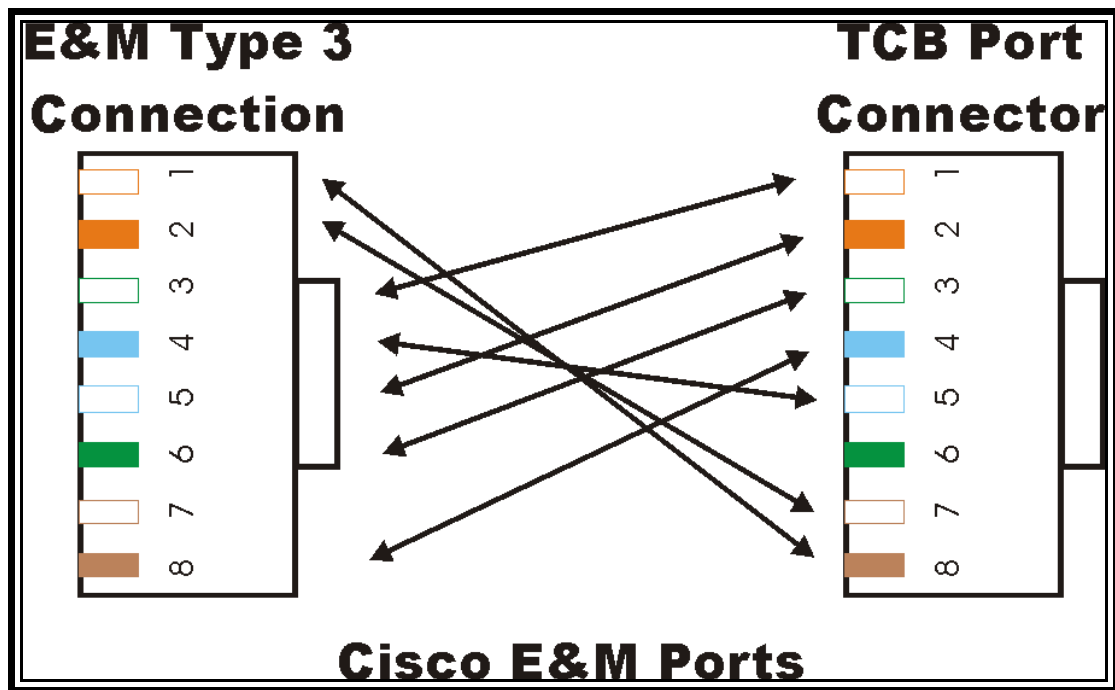
Step 3: Gently grasp one side of the lid, on either the left or right side and lift. The lid should easily be removed. On the front of the TCB-4, where the volume and microphone are located, a small PC board. On the top of the PC board is a 10 pin ribbon cable. Gently unplug the ribbon cable from the PC board. You may need a small flat blade screwdriver in order to get the ribbon cable unplugged from the connector. Once the ribbon cable is unplugged, fold the ribbon cable connector away from its mating PC board connector. Re-assemble the unit. Port 1 is now available for use.

Appendix B: E&M Type 3 Signaling

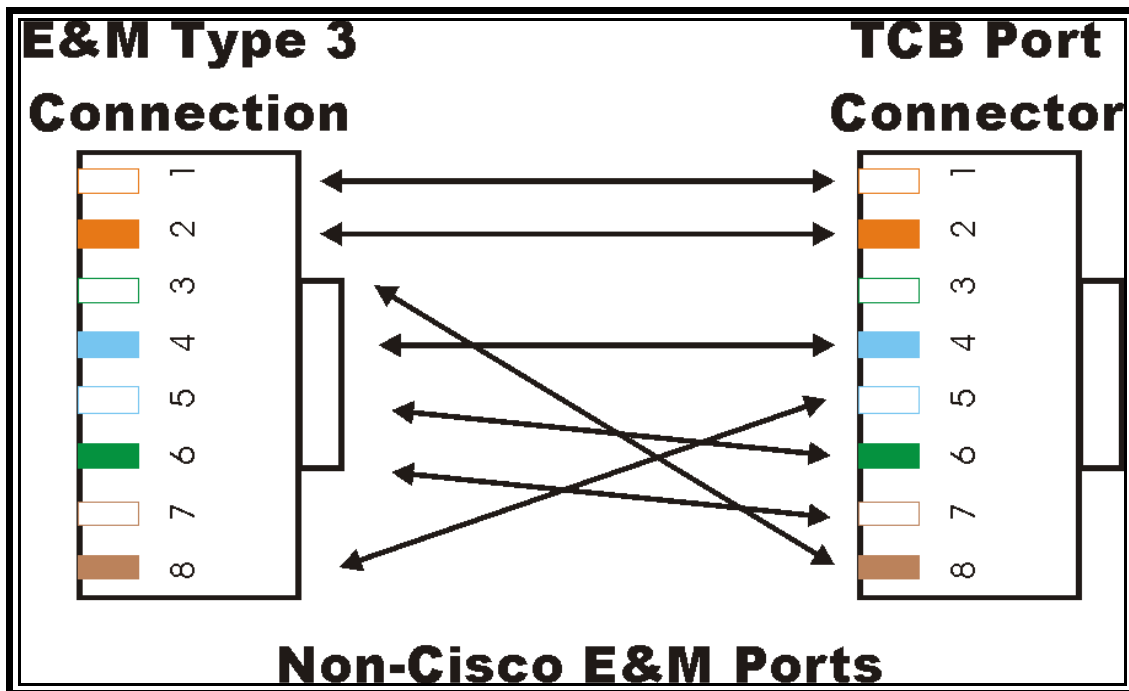
The TCB cable wiring discussed will connect to an E&M Type 3 router to the TCB's radio connector port. E&M is a handshaking process between two PBX's or VOIP routers. The 'E' stands for Ear circuit (Speaker) and the 'M' stands for Mouth circuit. (Microphone). For our discussion, 4 wire E&M circuits will be used. When connecting the TCB to an E&M interfaced router, a special cable will need to be fabricated. Link offers these cables for sale or you can follow the table below to build your own.

There are two flavors of the E&M interface cable. Certain Cisco routers use a different pinout than other E&M systems, so both types of cables are provided.

Cisco E&M Router	E&M Router RJ-45	TCB-4 Bridge	TCB-4 Bridge RJ-45	Pin
M Lead Input	White / Orange	PTT Output	Brown	8
E Lead Output	Orange	COR Input	White / Brown	7
T1 Audio Output	White / Green	Audio Input 1	White / Orange	1
R Audio Input	Blue	Audio Output 1	White / Blue	5
T Audio Output	White / Blue	Audio Input 2	Orange	2
R1 Audio Input	Green	Audio Output 2	White / Green	3
Ground	White / Brown	Not Used	-----	----
Battery (-48V)	Brown	External Ref	Blue	4

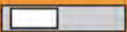

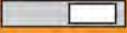
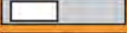
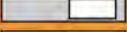
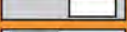
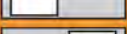
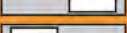




Other E&M Routers	E&M Router RJ-45	TCB-4 Bridge	TCB-4 Bridge RJ-45	Pin
M Lead Input	White / Orange	PTT Output	White / Orange	1
E Lead Output	Orange	COR Input	Orange	2
T1 Audio Output	White / Green	Audio Input 1	Brown	8
R Audio Input	Blue	Audio Output 1	Blue	4
T Audio Output	White Blue	Audio Input 2	Green	6
R1 Audio Input	Green	Audio Output 2	White / Brown	7
Ground	White / Brown	Not Used	-----	----
Battery (-48V)	Brown	External Ref	White / Blue	5



Switch Settings:

When connecting the TCB to a VOIP or similar router that requires an E&M Type 3 interface, balanced and opto-isolated inputs are required. The TCB's flexible interface configuration supports this common format.

1		On	Switch 1: (Off)
2		On	Switch 2: (Off)
3		On	Switch 3: (On) Reference 'M' lead to external -48V battery
4		On	Switch 4: (Off)
5		On	Switch 5: (On) Opto-Isolators reference -48V battery
6		On	Switch 6: (On) Balanced Receiver Audio Selected
7		On	Switch 7: (Off)
8		On	Switch 8: (On) Balanced Transmit Audio Selected
9		On	Switch 9: (Off)
10		On	Switch 10: (On) Balanced Receiver Audio Selected

TCB-1:

The switch settings are located on the back of the unit

TCB-4, TCB-3 and TCB-4:

The switch settings are located on the radio card where you are attaching the E&M signal

Radio Audio Personality Settings:

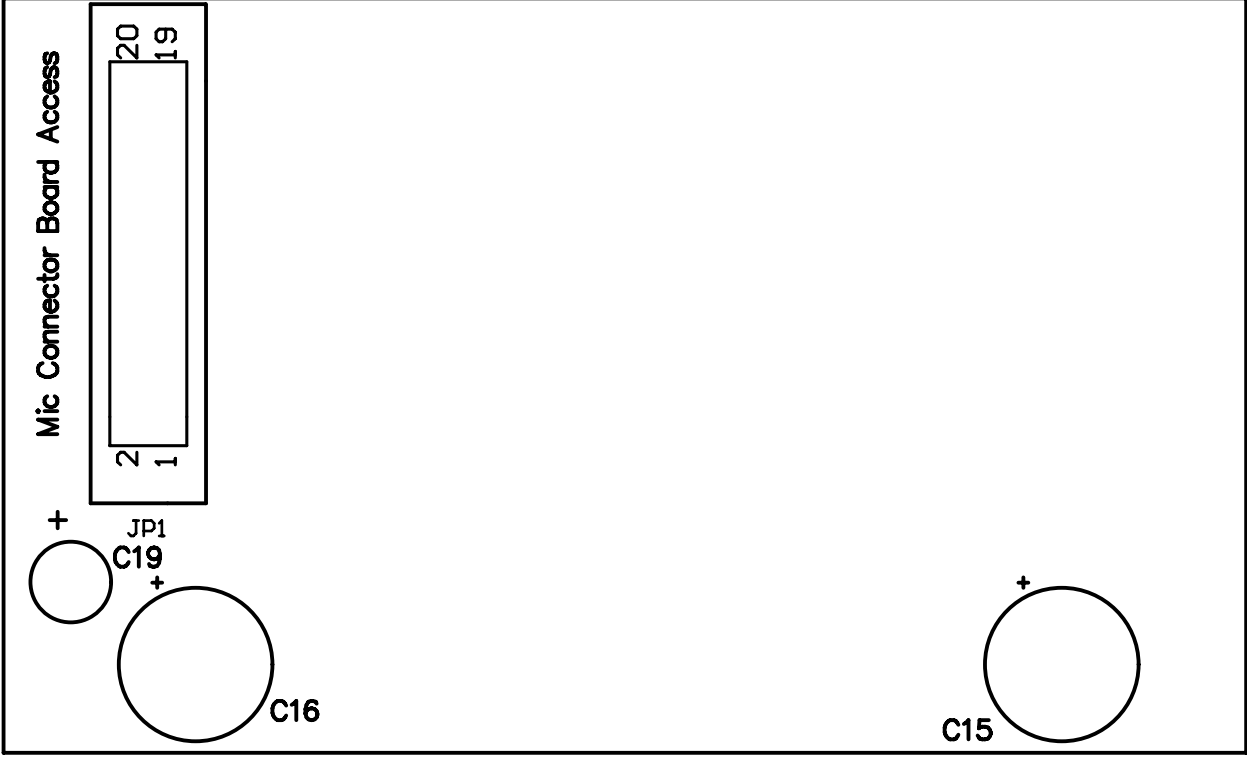
E&M settings require 10% Line Level, VOX access mode and receiver AGC enabled

Appendix D

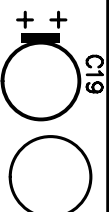
Schematics and Component Layout

The TCB-4 is a complex, multiple DSP based communications device. Servicing of the unit must be performed by an authorized service technician. Damage can occur to the boards if not handled with Static Handling Precautions.

Schematics and component layout are provided for reference purpose only. Unauthorized modifications, changes or reverse engineering is prohibited without the express written permission of Link Communications, Inc. All materials contained are owned Copyrights of Link Communications, Inc.



TCB-2 Connector Board
Mount On Back



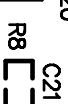
TCB-2 Amplifier Module
© 2004 Rev. C Ser#

C16



U2

C20



C21



R8

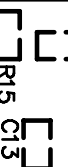


R1

R2

R7

C7

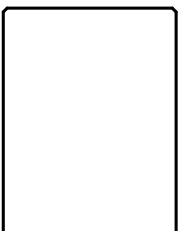


R15

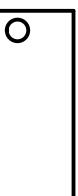
C13



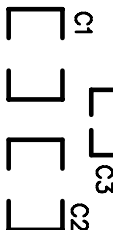
R11



U1



C9



C1

C2

C3

L1

L2



R4



R3

R6

R10



C12



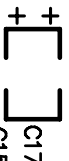
R12

R13

R14



C10



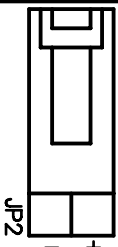
C17

C15

(w/ up to 8) speakers

Int Speaker: Jump S11, S12
Ext Speaker: Jump SE1, SE2
Int Volume: Jump V1
Ext Volume: Jump VE

Speaker Configuration

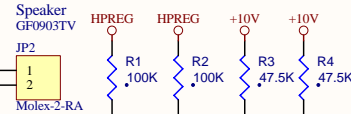
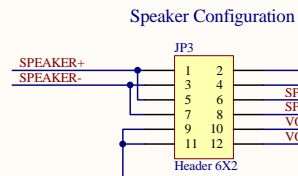
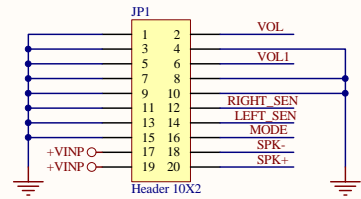


JP2

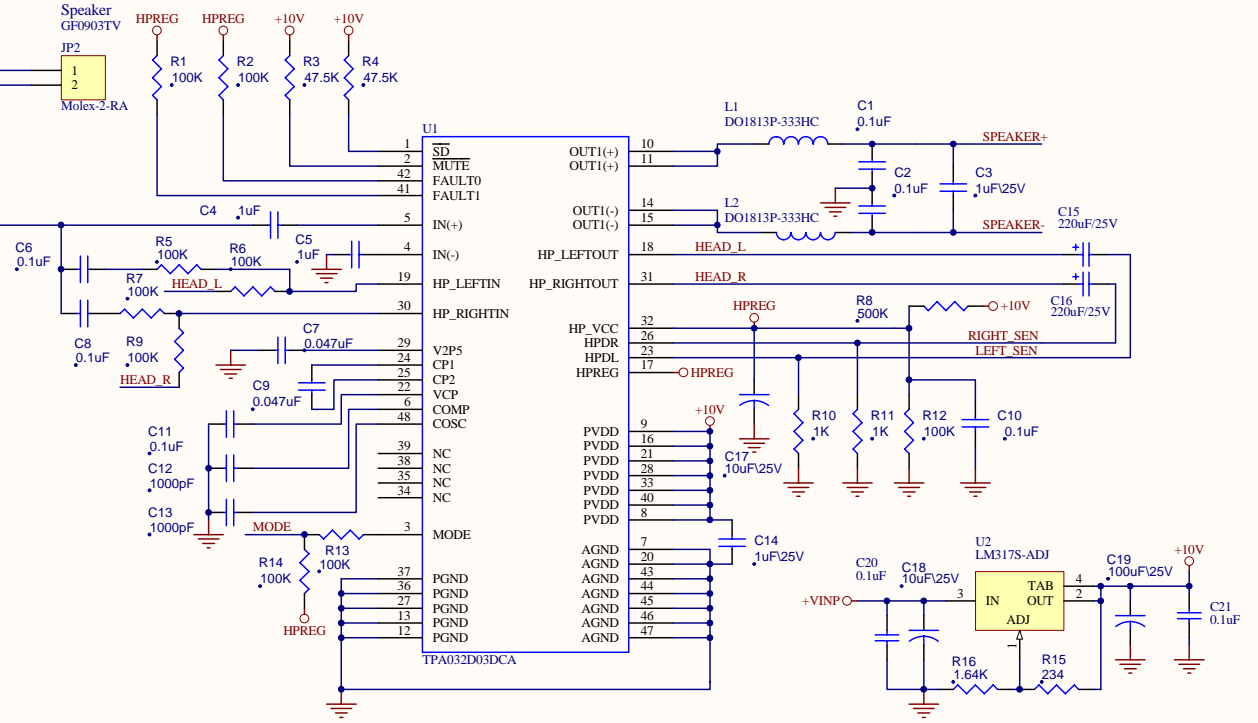


JP3

S11 S12 SE1 SE2 V1 VE



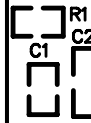
Speaker Selection Table	
Jump 1,2 & 3,4 & 9,10 - Internal Speaker (Default)	
Jump 5,6 & 7,8 & 11,12 - External Speaker	
(External Speaker Available on pin 1,2 of the RJ-45 Microphone Jack)	
(External Volume Control Available on pin 4 (gnd), pin 7 (arm), pin 8 (high))	
(To utilize the TCB-2's volume pot when external speaker is used, install jumper 9,10. Now external speaker with internal volume pot is available)	



Link Communications, Inc. 1035 Cerise Rd, Billings, Montana 59101 Phone: +406-245-5002 Fax: +406-245-4889			Description Console Amplifier		
Drawing Number	Date	Revision	Sheet	Total	
TCB-2 Console	Feb. 13, 2004	C	1	1	

AW0012204

SER#



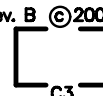
TCB-2
Connector Board

DS1

Rev. B ©2004



U1



C3

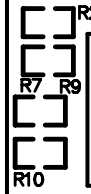
Pin 1



R4



U2



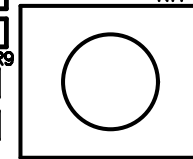
R2

R7

R9

R10

R11



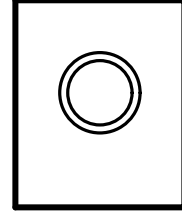
C6

C6



R8

J1



C5

C5



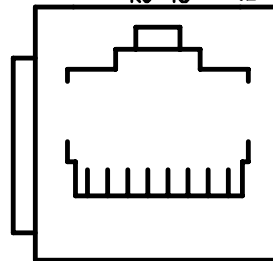
R5



RJ-45

J2

Pin 1



R3

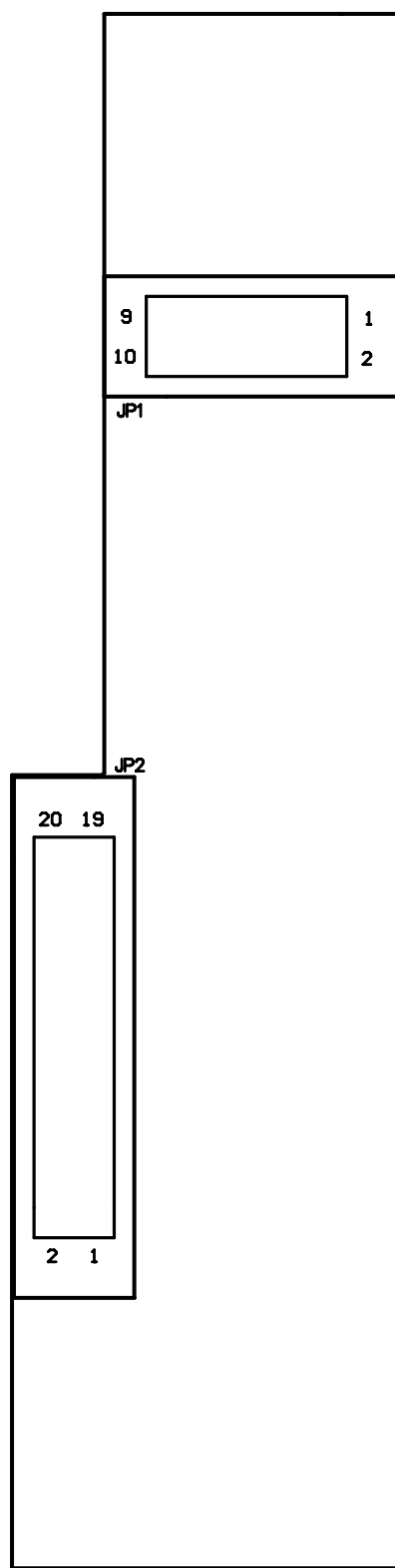


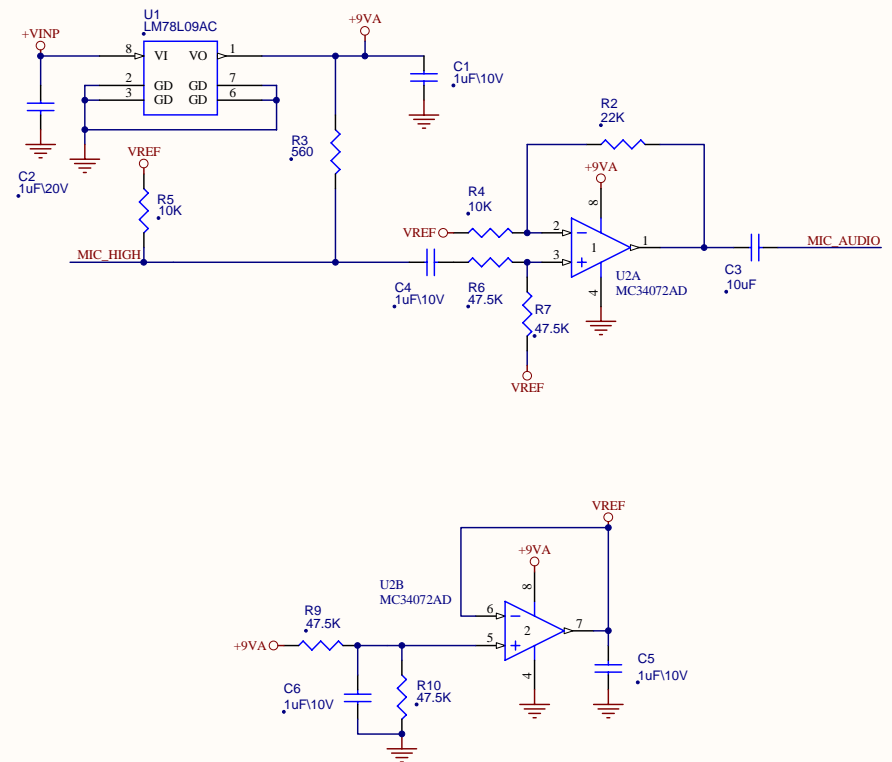
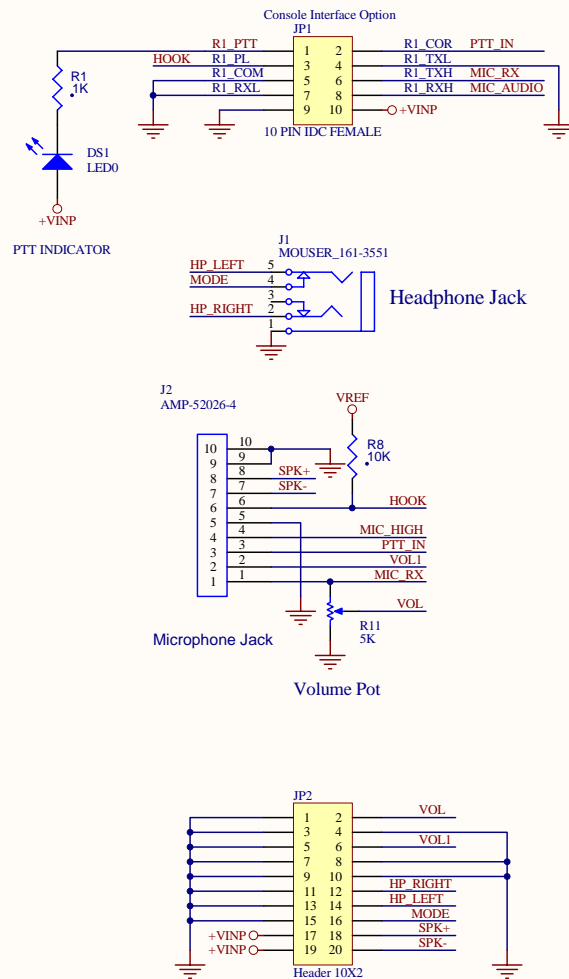
C4

C4

R6

R6





Link Communications, Inc.
1035 Cerise Rd, Billings, Montana 59101
Phone: +406-245-5002 Fax: +406-245-4889

Description

Console Connectors

Drawing Number

TCB-2 Console

Date

Feb. 19, 2004

Revision

B

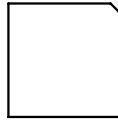
Sheet

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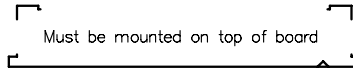
Total

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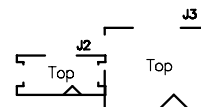
U5

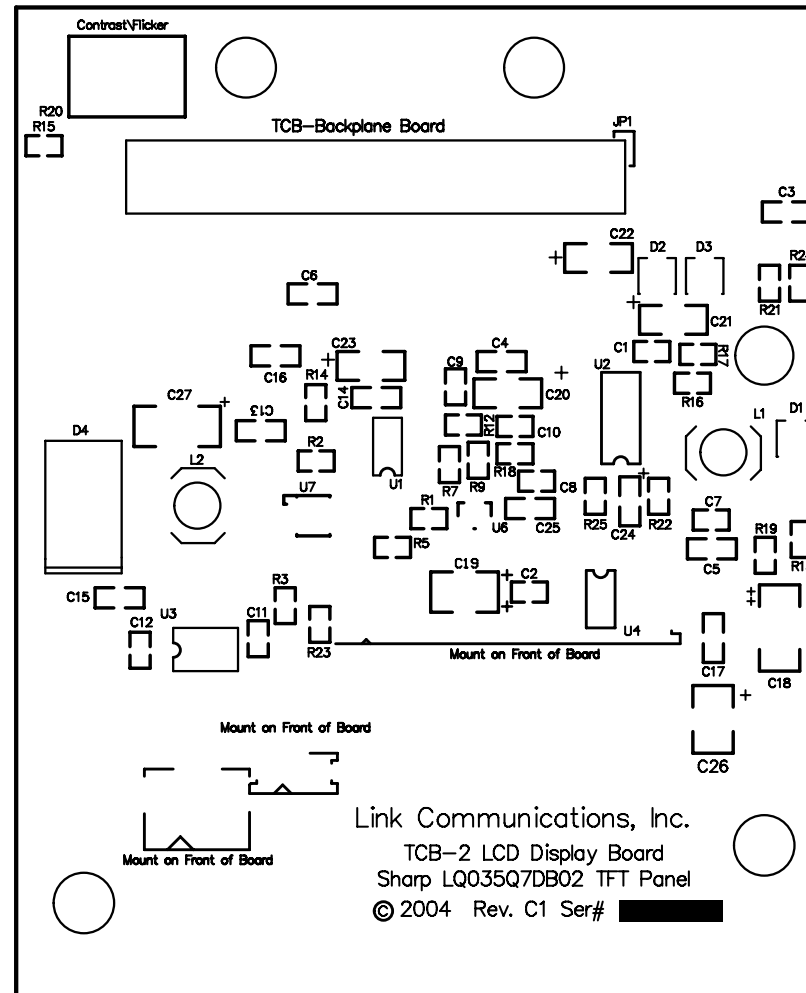


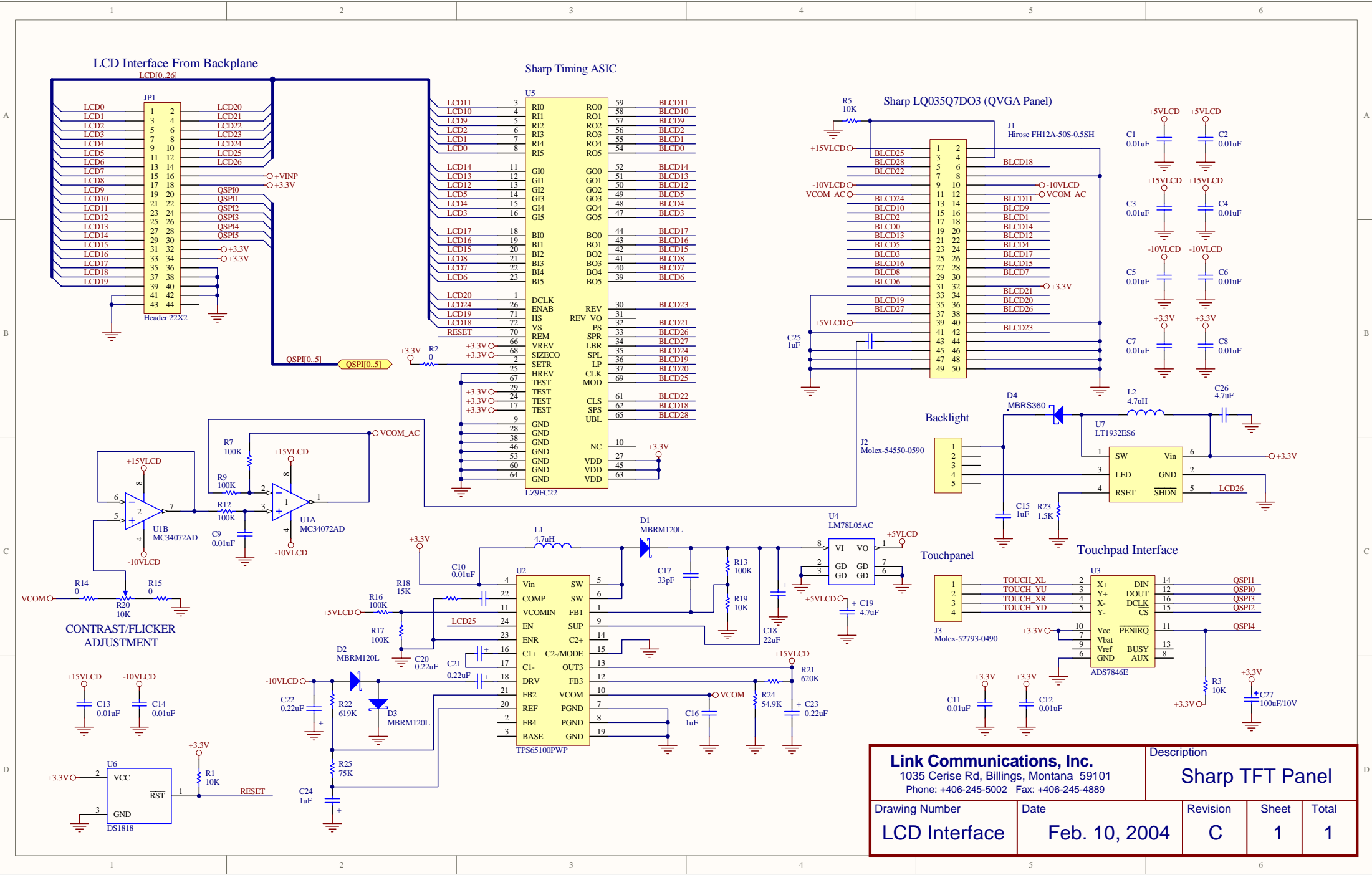
J1



Must be mounted on top of board

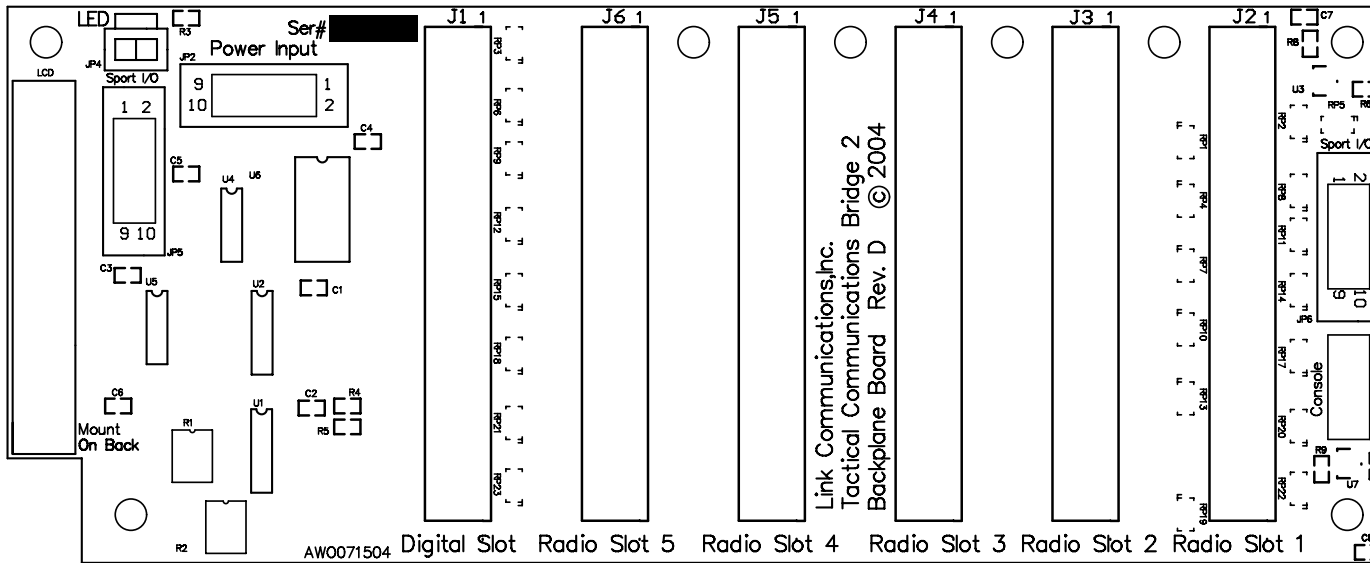


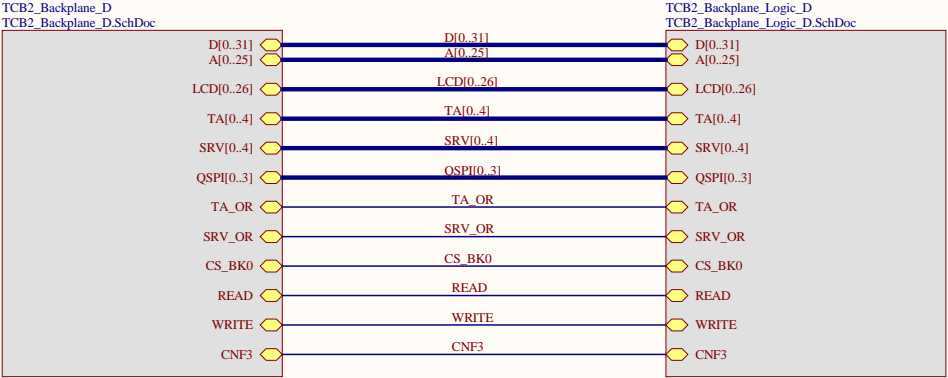




Link Communications, Inc. 1035 Cerise Rd, Billings, Montana 59101 Phone: +406-245-5002 Fax: +406-245-4889		Description Sharp TFT Panel		
Drawing Number LCD Interface	Date Feb. 10, 2004	Revision C	Sheet 1	Total 1

Top Legend Layer

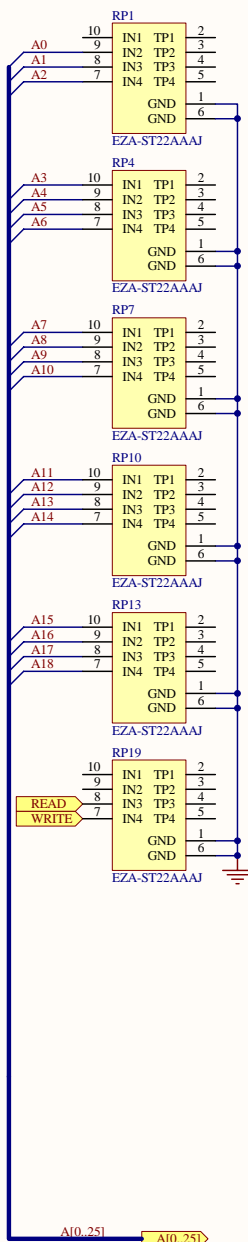




Link Communications, Inc. 1035 Cerise Rd, Billings, Montana 59101 Phone: +406-245-5002 Fax: +406-245-4889			Description Connections Sheet		
Drawing Number	Date		Revision	Sheet	Total
TCB-II Backplane	July 2, 2004		D	1	3

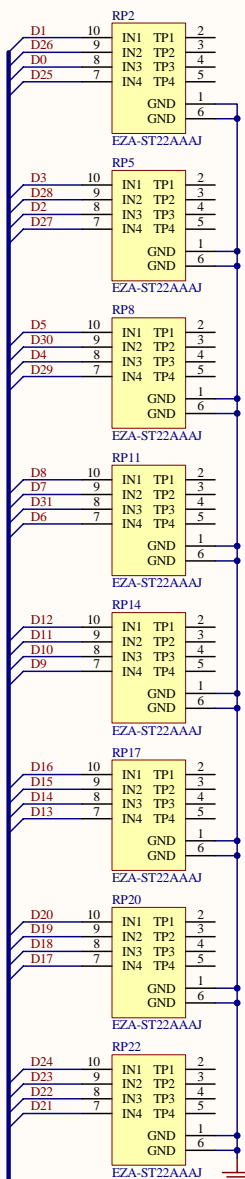
Address Bus Termination

Located at Radio Card 1

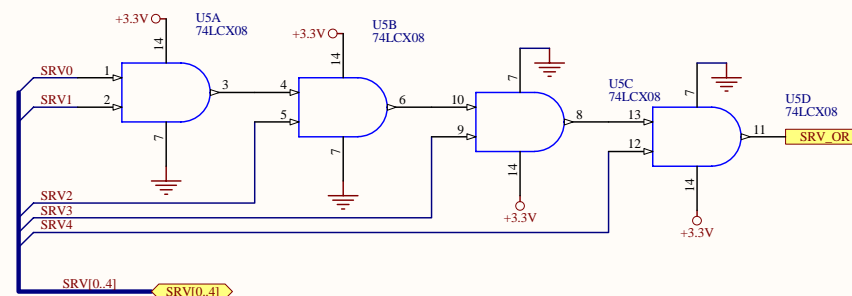
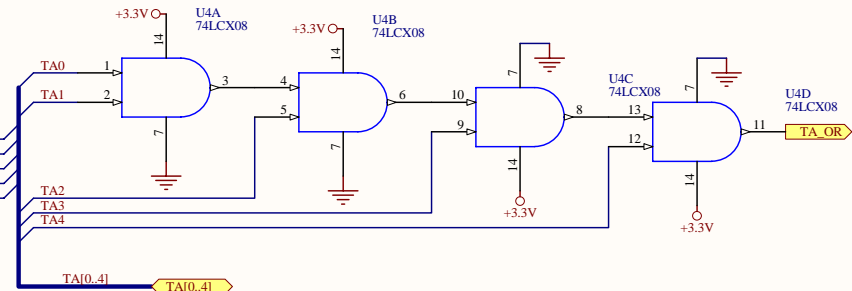
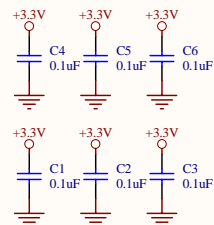
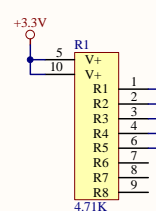
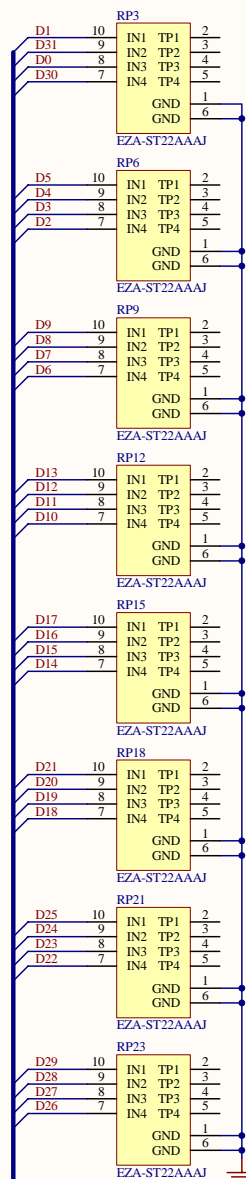


Data Bus Terminations

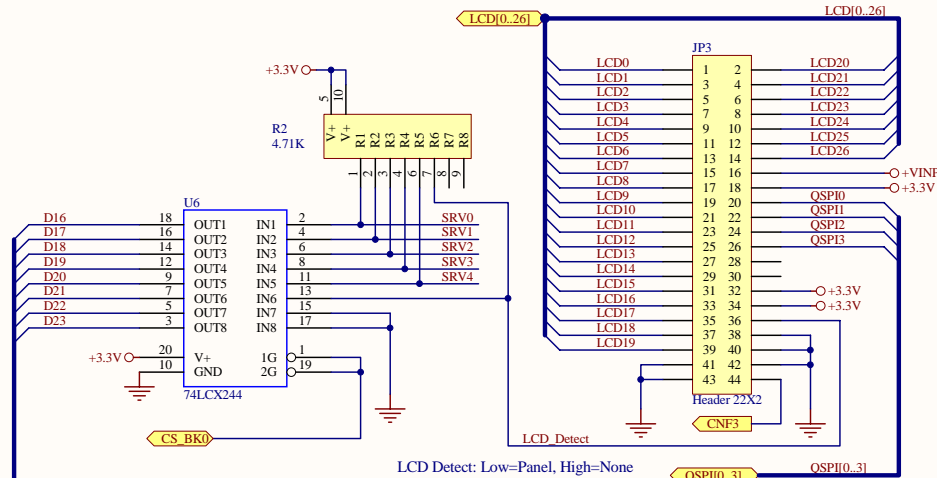
Locate one set at Radio Card 1



Locate one set at Radio Card 5



LCD Front Panel Interface

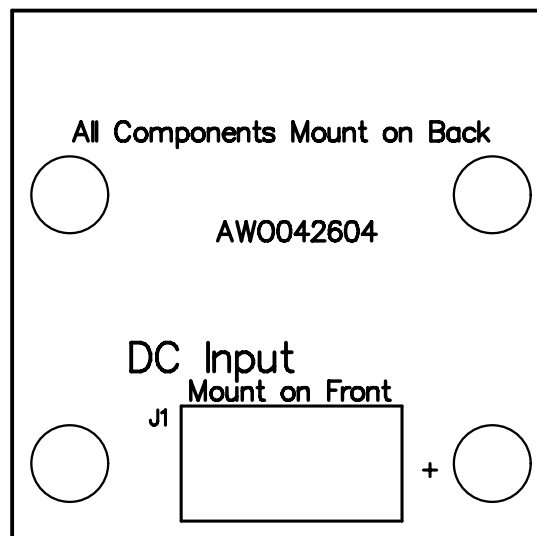


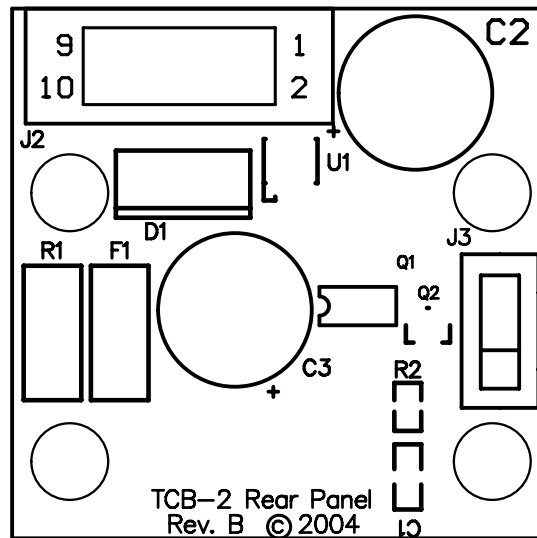
Link Communications, Inc.
1035 Cerise Rd, Billings, Montana 59101
Phone: +406-245-5002 Fax: +406-245-4889

Description

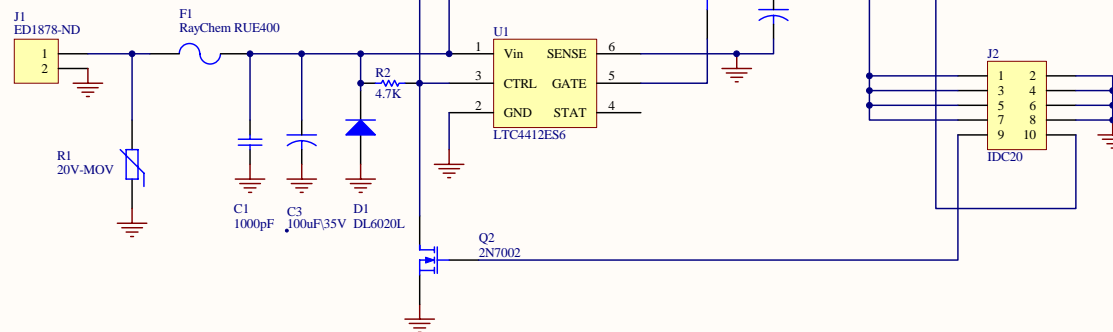
Logic / LCD Conn

Drawing Number	Date	Revision	Sheet	Total
TCB-2 Backplane	April 23, 2004	D	3	3





External DC In



When switch is in the 1-2 position, the system power is on
When switch is in the 2-3 position, the system power is off, waiting for uprocessor to release power

TCB-2 Power Switch

TCB-2 Power

Link Communications, Inc.
1035 Cerise Rd, Billings, Montana 59101
Phone: +406-245-5002 Fax: +406-245-4889

Description

Rear Power Plate

Drawing Number

TCB-2

Date

March 05, 2004

Revision

B

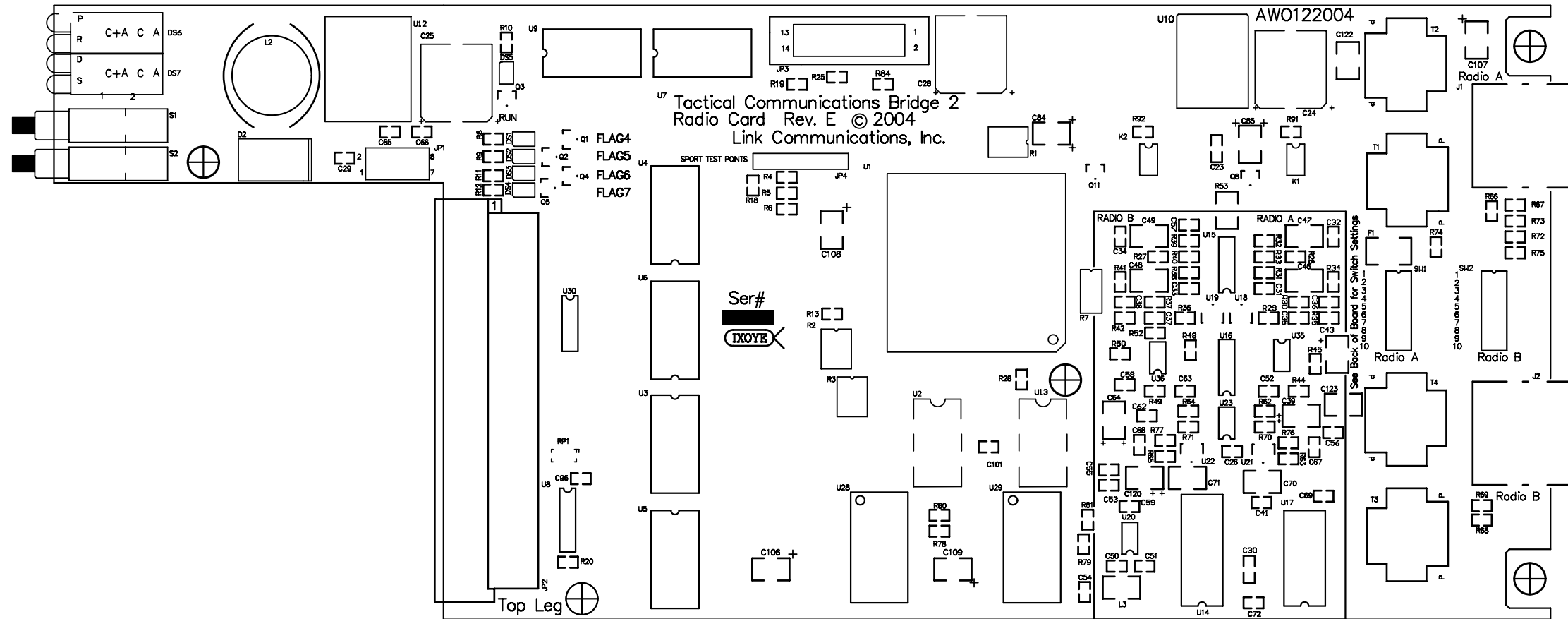
Sheet

1

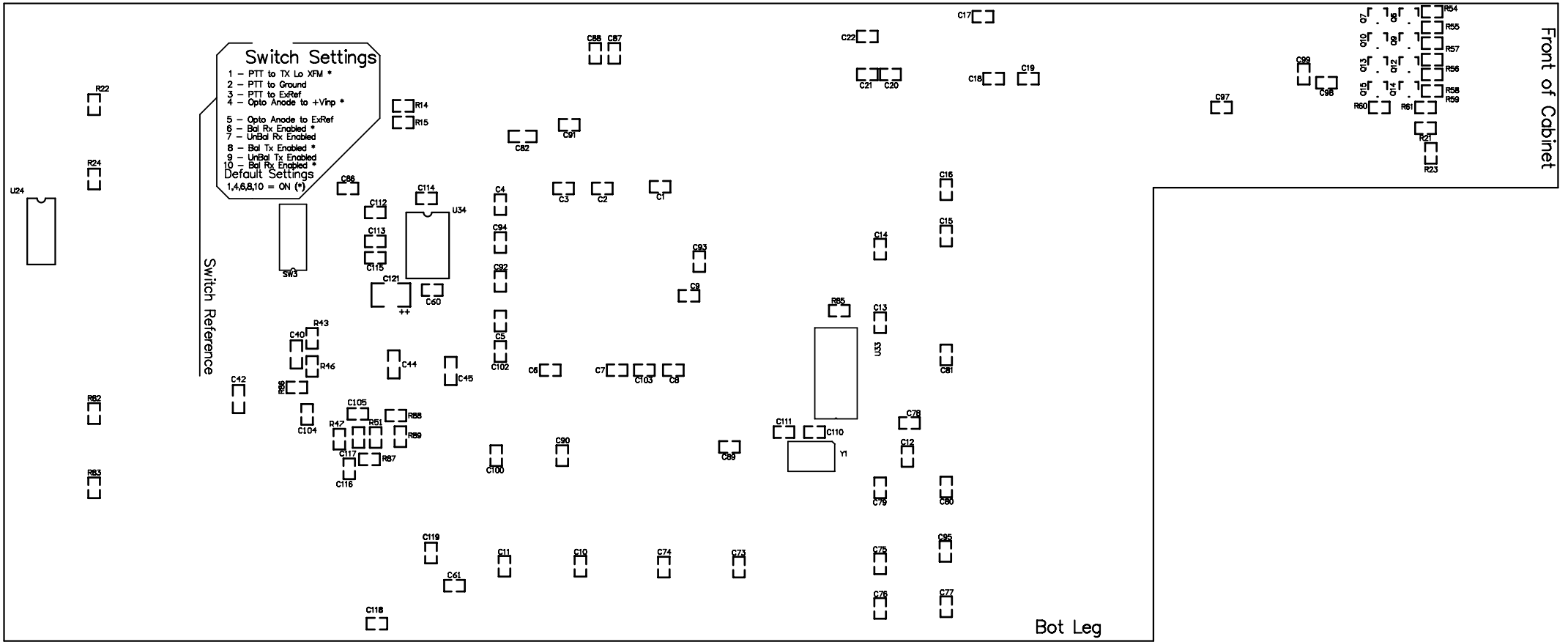
Total

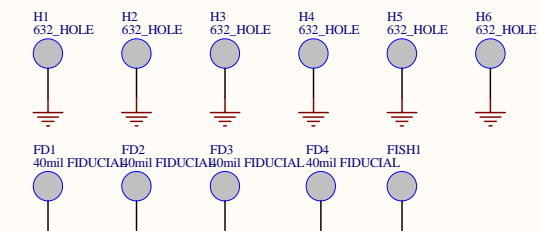
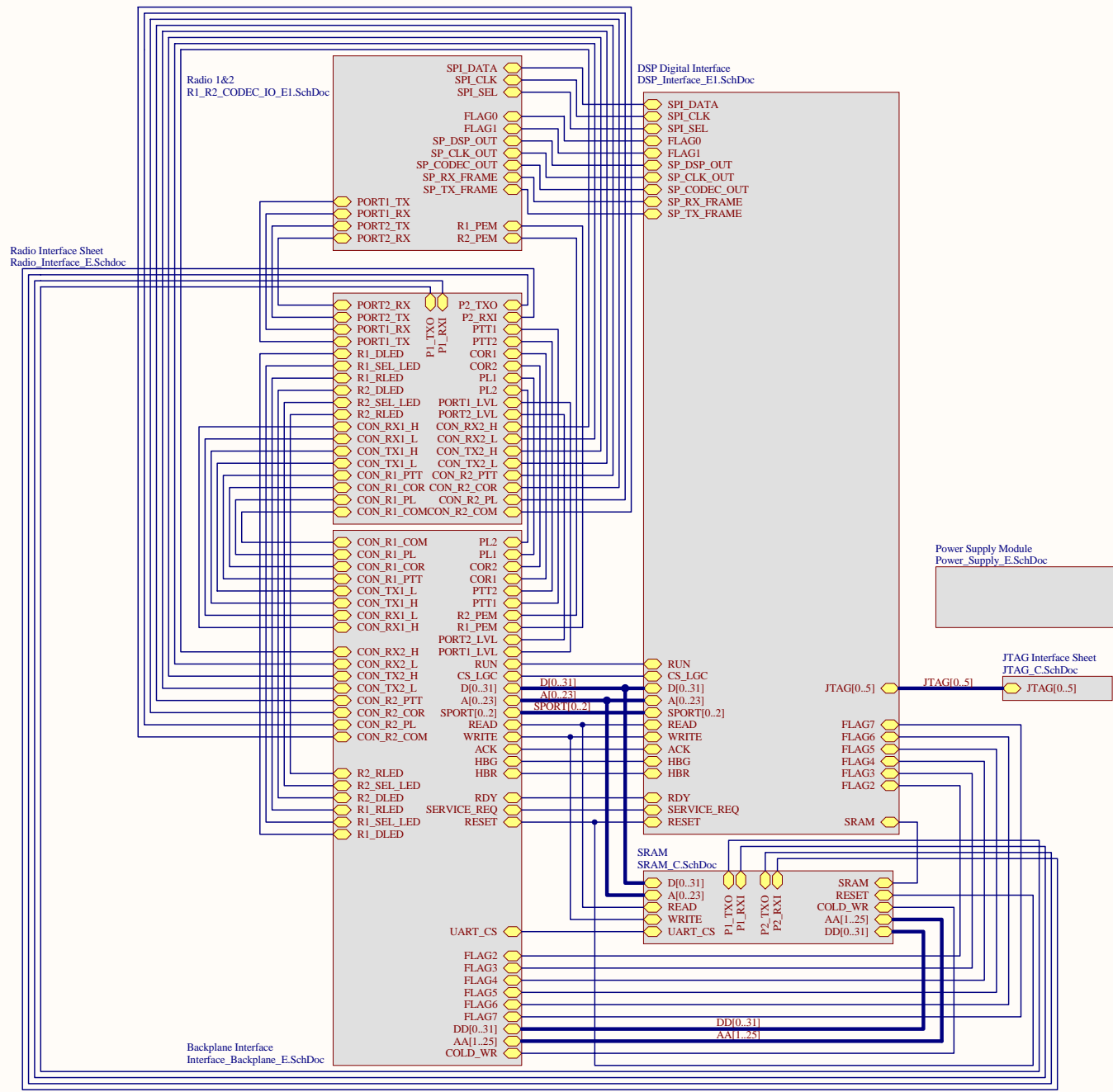
1

Top Overlay



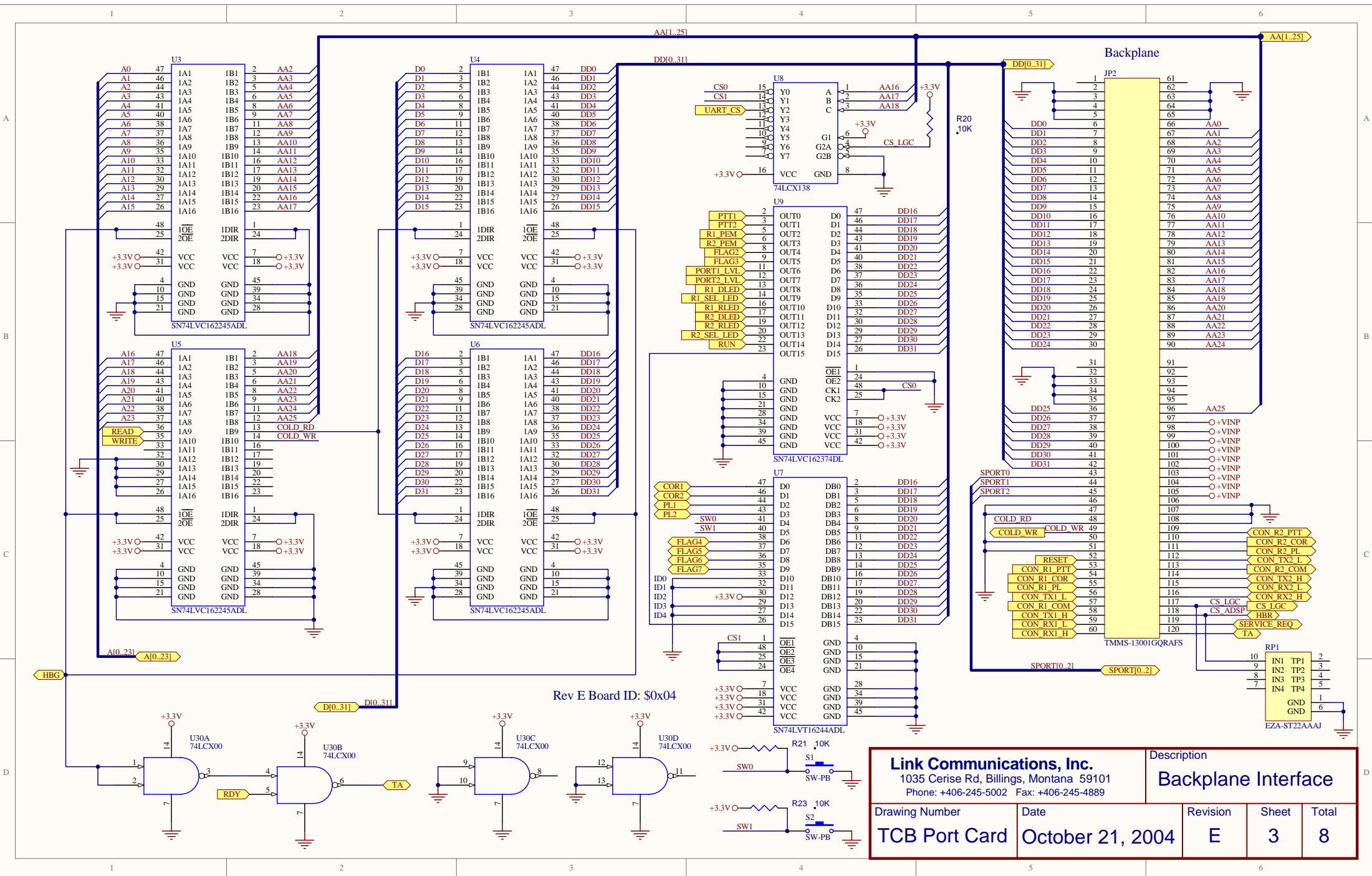
Bottom Overlay



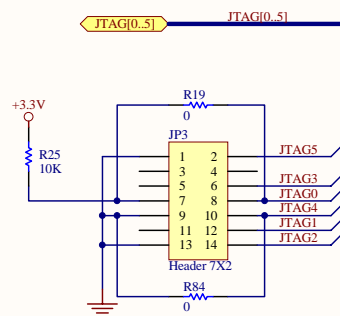


Link Communications, Inc. 1035 Cerise Rd, Billings, Montana 59101 Phone: +406-245-5002 Fax: +406-245-4889				Description Sheet Connections	
Drawing Number TCB Port Card	Date Aug. 31, 2005	Revision E1	Sheet 1	Total 8	





Link Communications, Inc. 1035 Cerise Rd, Billings, Montana 59101 Phone: +406-245-5002 Fax: +406-245-4889		Description Backplane Interface		
Drawing Number TCB Port Card	Date October 21, 2004	Revision E	Sheet 3	Total 8



Load JP3 for Engineering Units Only
Remove R19, R84 for Engineering Units Only

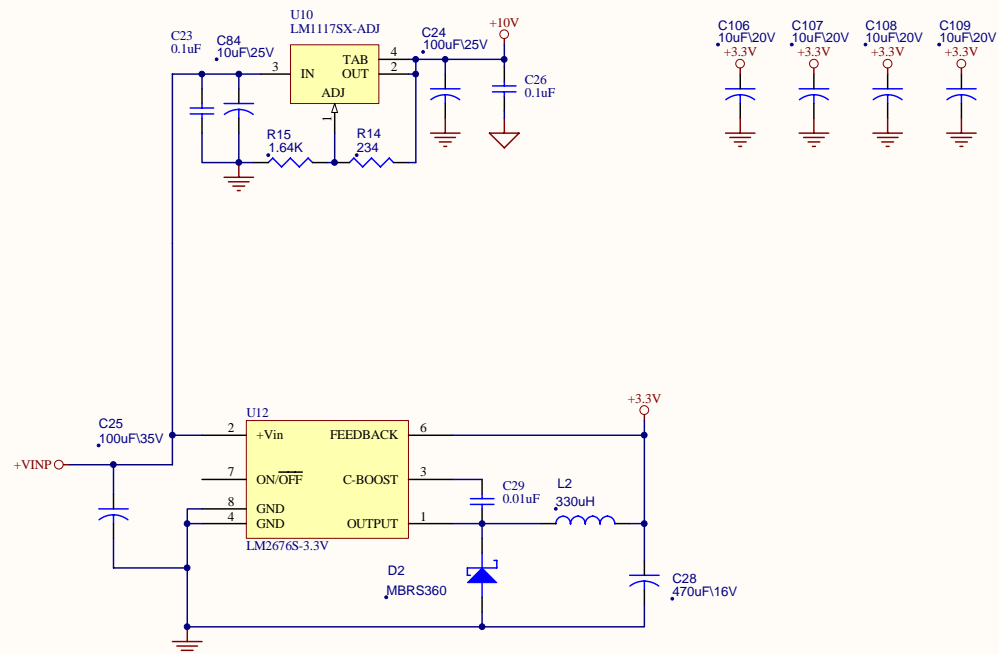
JTAG Interface Connector
Pin 3 needs to be cut

Link Communications, Inc.
1035 Cerise Rd, Billings, Montana 59101
Phone: +406-245-5002 Fax: +406-245-4889

Description

JTAG Interface

Drawing Number	Date	Revision	Sheet	Total
TCB Port Card	Mar. 31, 2004	C	4	8



Link Communications, Inc.
 1035 Cerise Rd, Billings, Montana 59101
 Phone: +406-245-5002 Fax: +406-245-4889

Description

Power Supplies

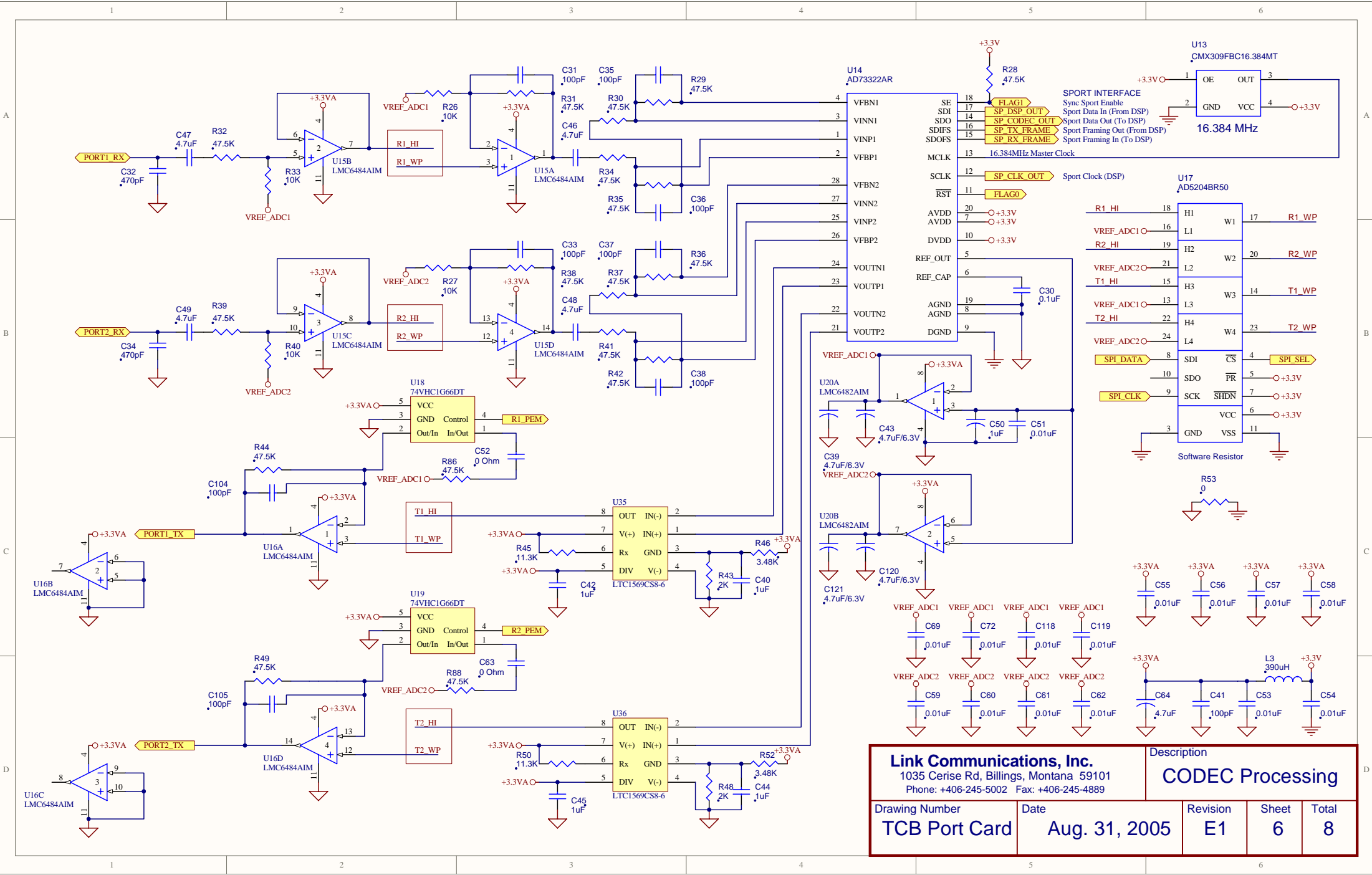
Drawing Number
TCB Port Card

Date
Dec. 20, 2004

Revision
E

Sheet
5

Total
8

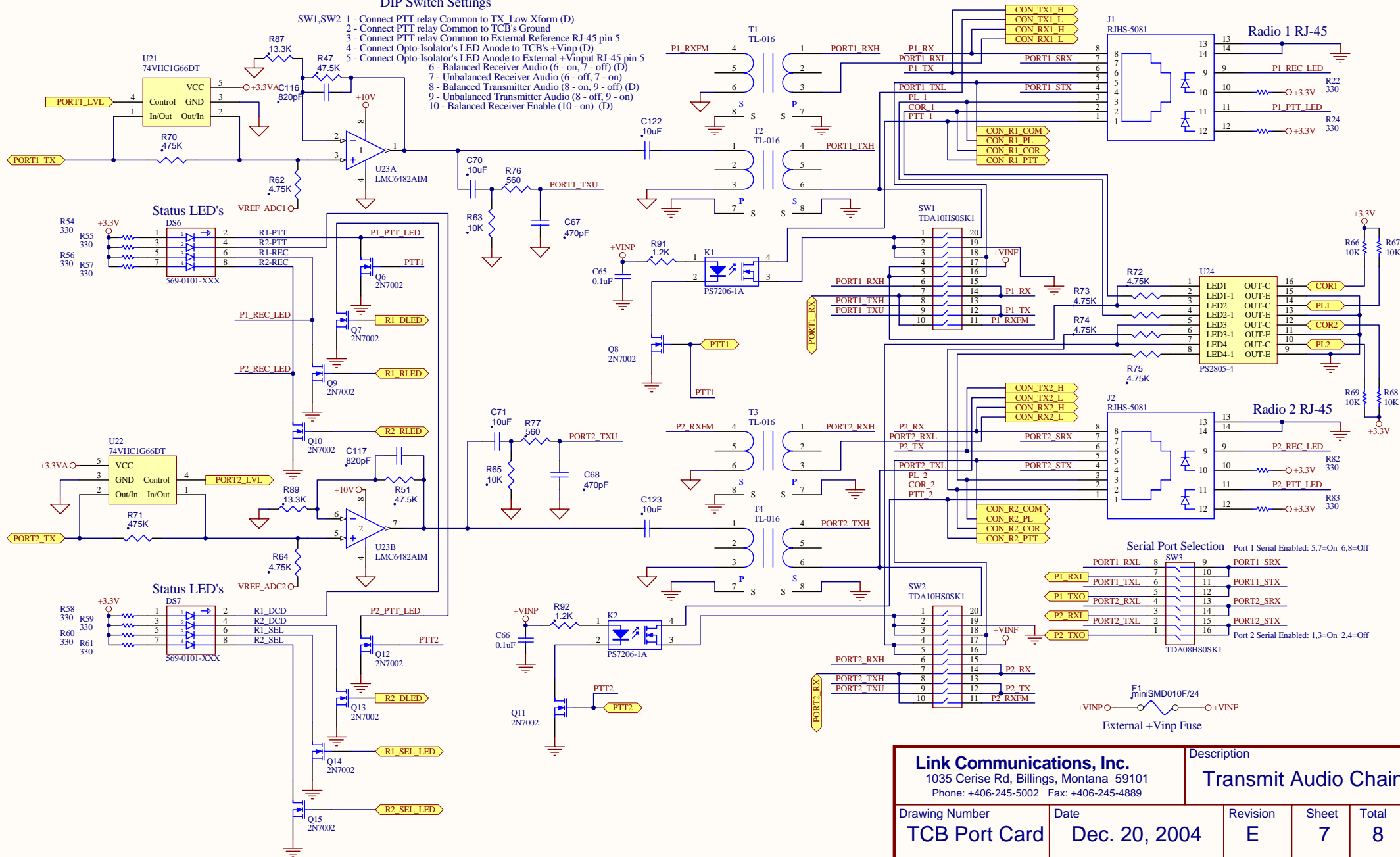


Link Communications, Inc. 1035 Cerise Rd, Billings, Montana 59101 Phone: +406-245-5002 Fax: +406-245-4889		Description CODEC Processing			
Drawing Number TCB Port Card	Date Aug. 31, 2005	Revision E1	Sheet 6	Total 8	

DIP Switch Settings

- SW1,SW2 1 - Connect PTT relay Common to TX_Low Xform (D)
 2 - Connect PTT relay Common to TCB's Ground
 3 - Connect PTT relay Common to External Reference RJ-45 pin 5
 4 - Connect Opto-Isolator's LED Anode to TCB's +Vinp (D)
 5 - Connect Opto-Isolator's LED Anode to External RJ-45 pin 5
 6 - Balanced Receiver Audio (6 - on, 7 - off) (D)
 7 - Unbalanced Receiver Audio (6 - off, 7 - on)
 8 - Balanced Transmitter Audio (8 - on, 9 - off) (D)
 9 - Unbalanced Transmitter Audio (8 - off, 9 - on)
 10 - Balanced Receiver Enable (10 - on) (D)

(D) Refers to the Default Dip Switch Setting. Switch is in the 'ON' position



Link Communications, Inc.
 1035 Cerise Rd, Billings, Montana 59101
 Phone: +406-245-5002 Fax: +406-245-4889

Description

Transmit Audio Chain

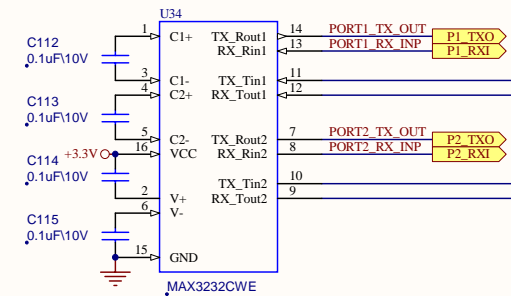
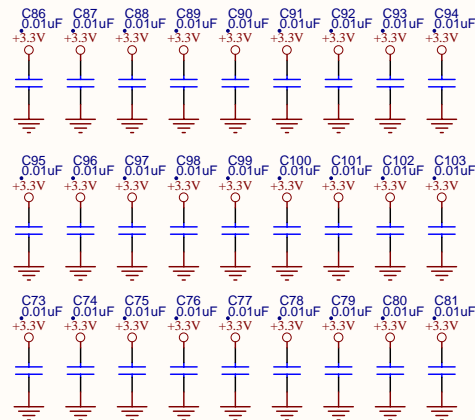
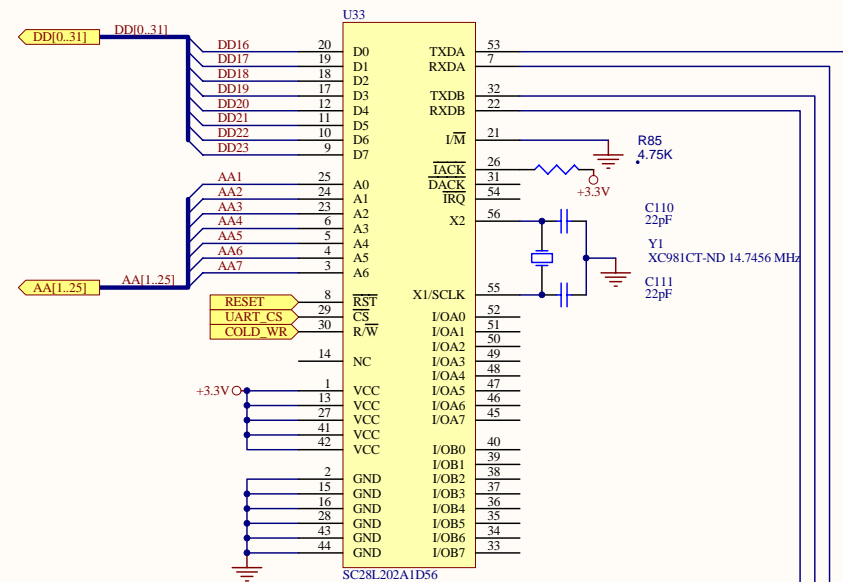
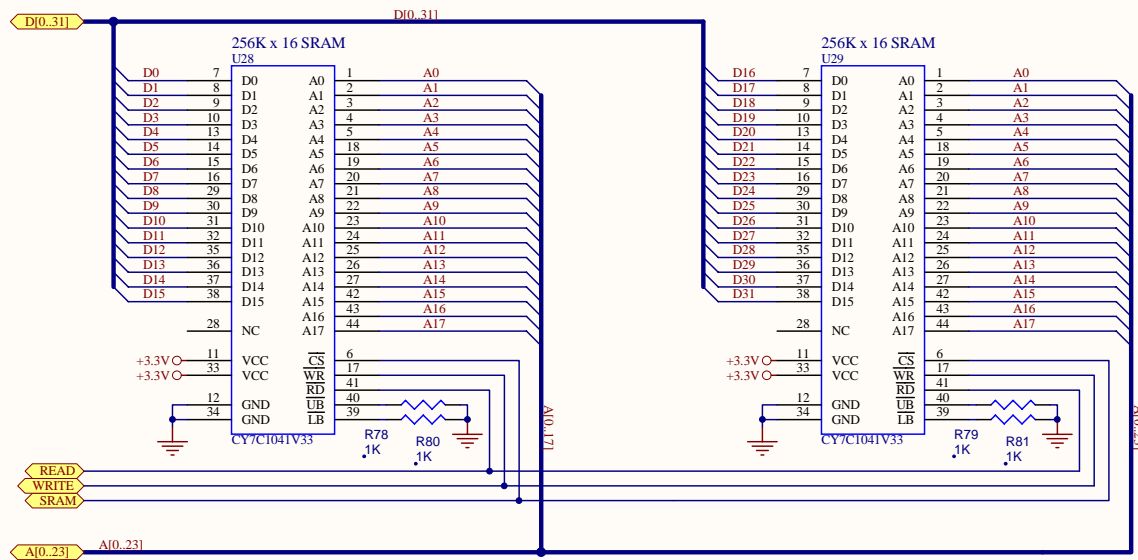
Drawing Number
TCB Port Card

Date
Dec. 20, 2004

Revision
E

Sheet
7

Total
8



Rear Panel RS-232 Ports

Link Communications, Inc.
1035 Cerise Rd, Billings, Montana 59101
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Description

SRAM Interface

Drawing Number
TCB Port Card

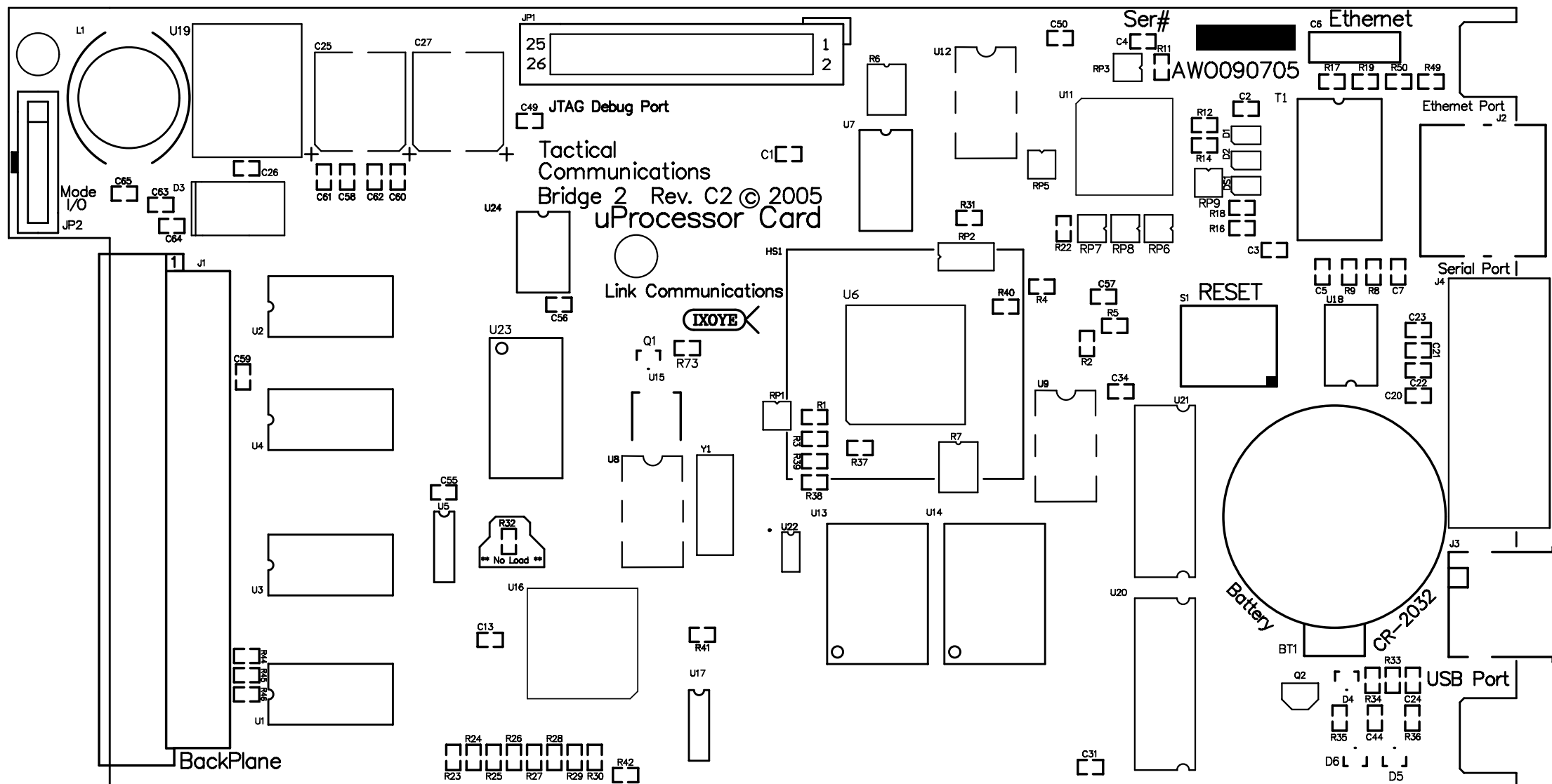
Date
April 19, 2004

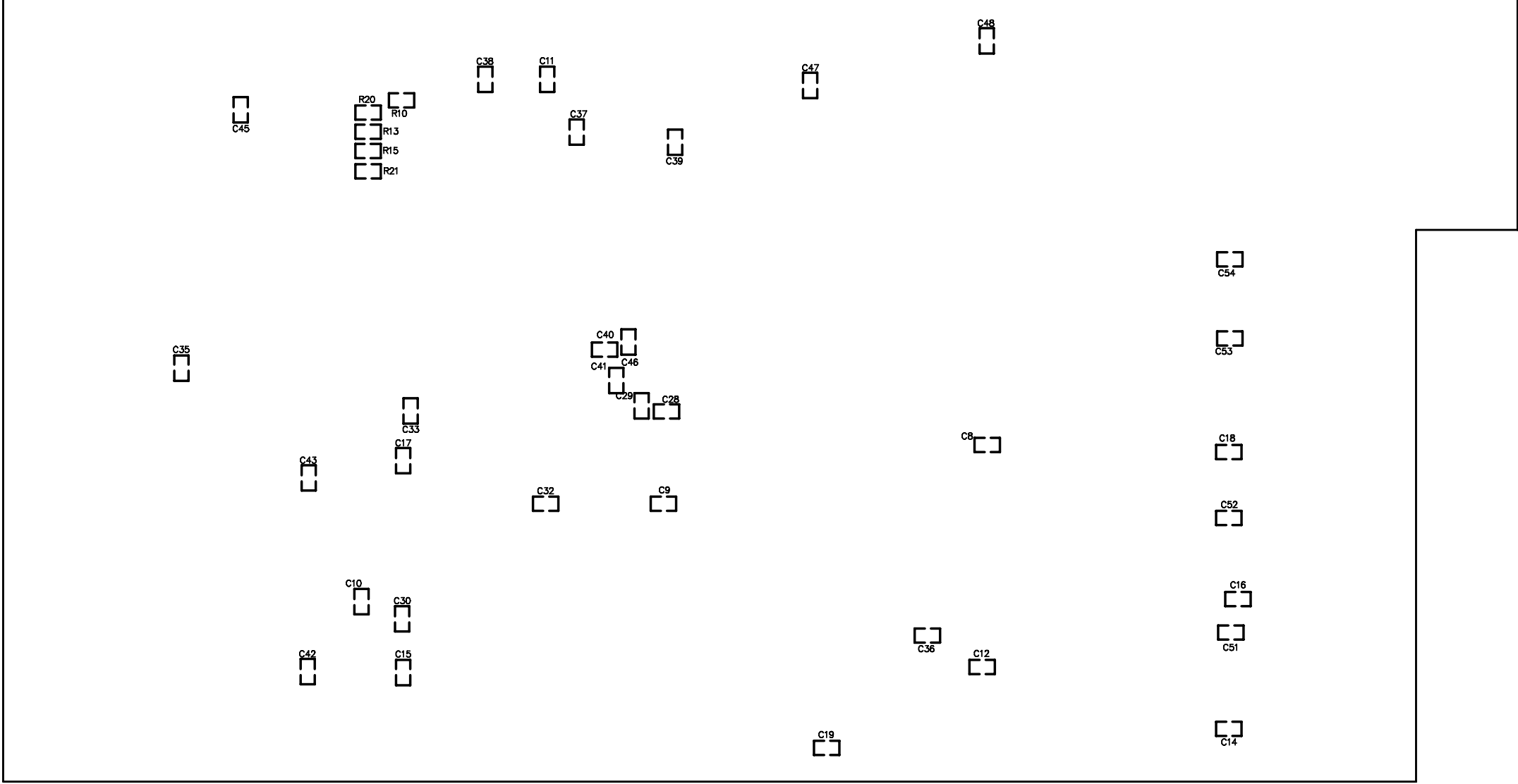
Revision
C

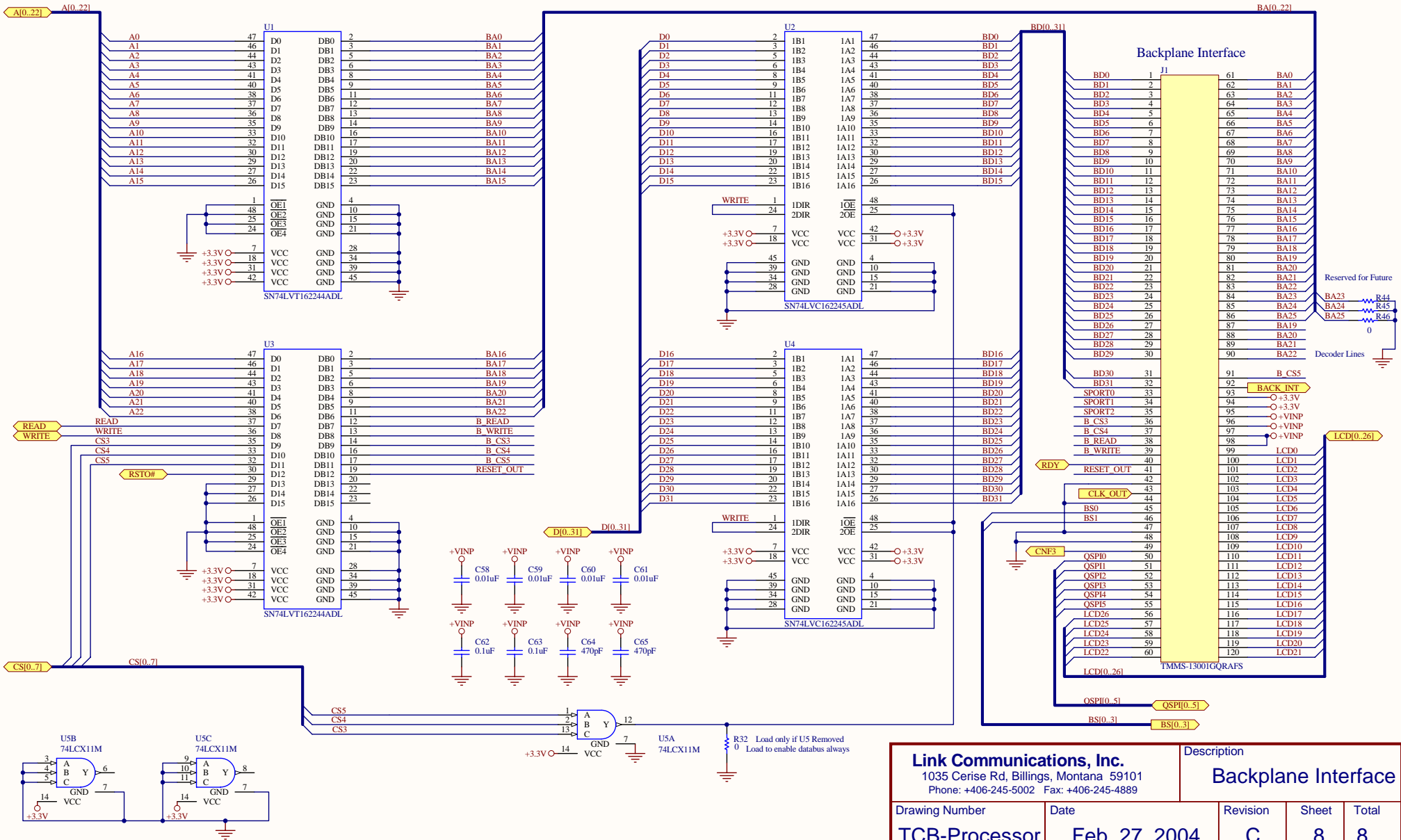
Sheet
8

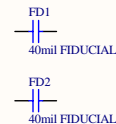
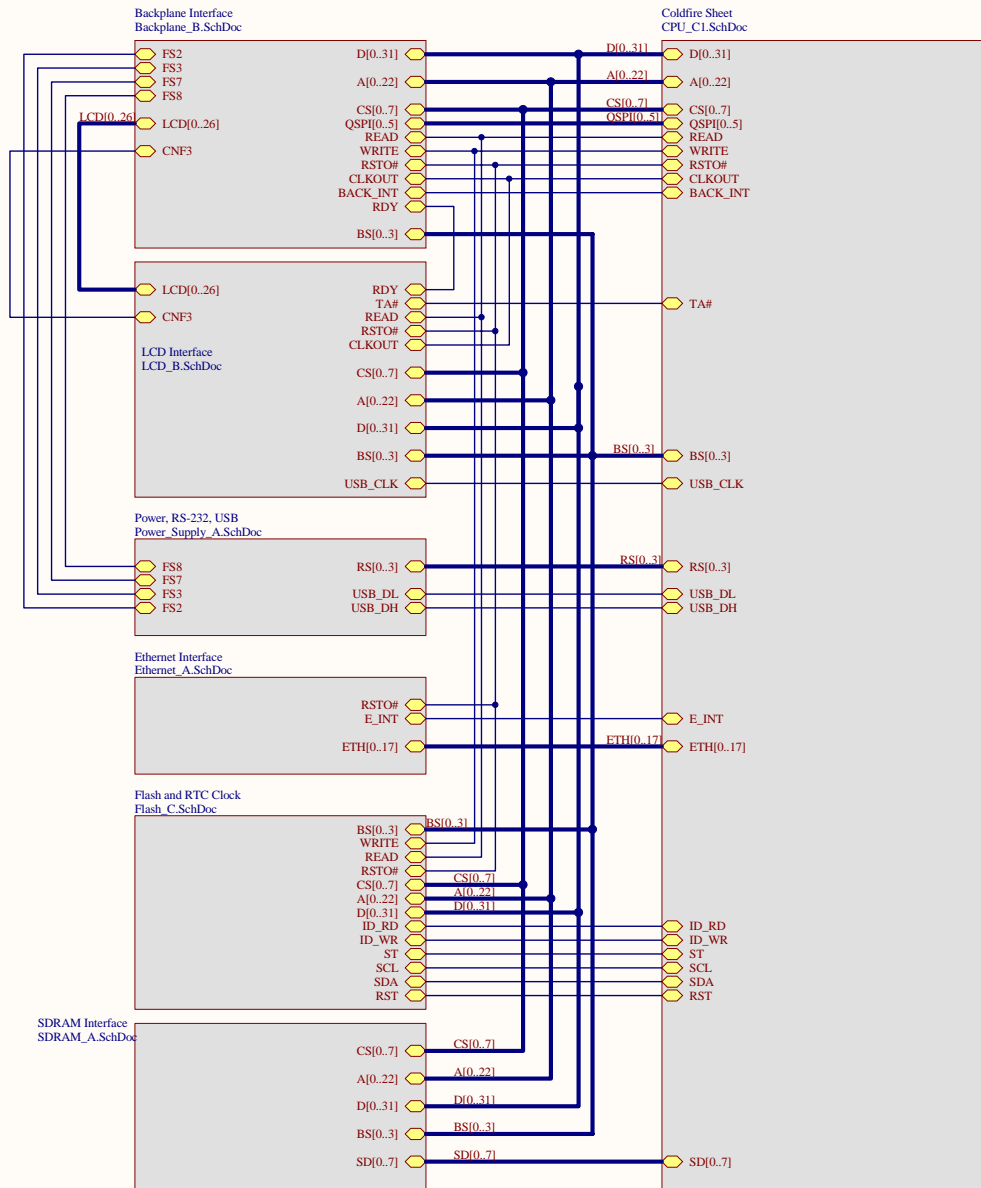
Total
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Top Overlay

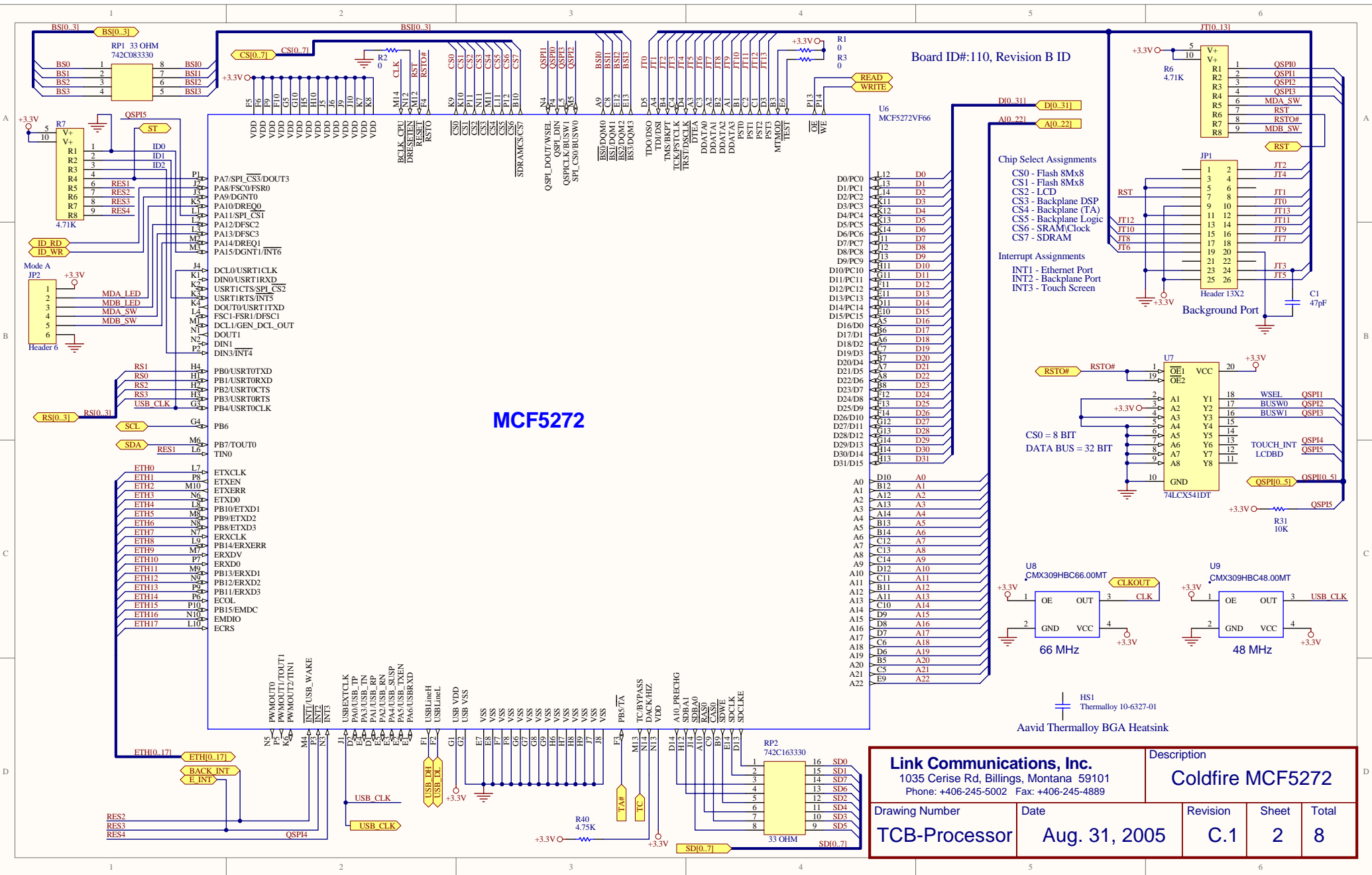


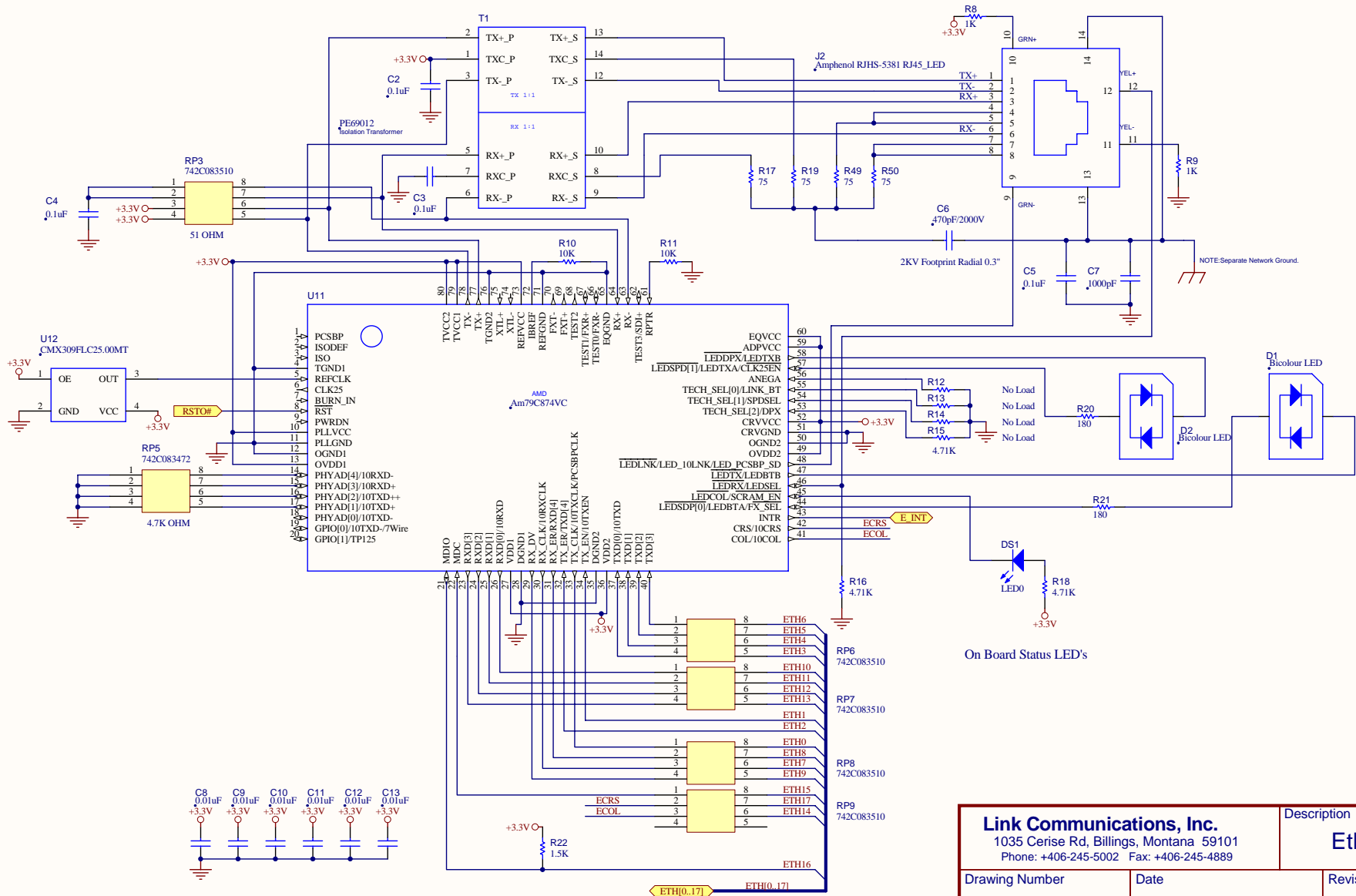




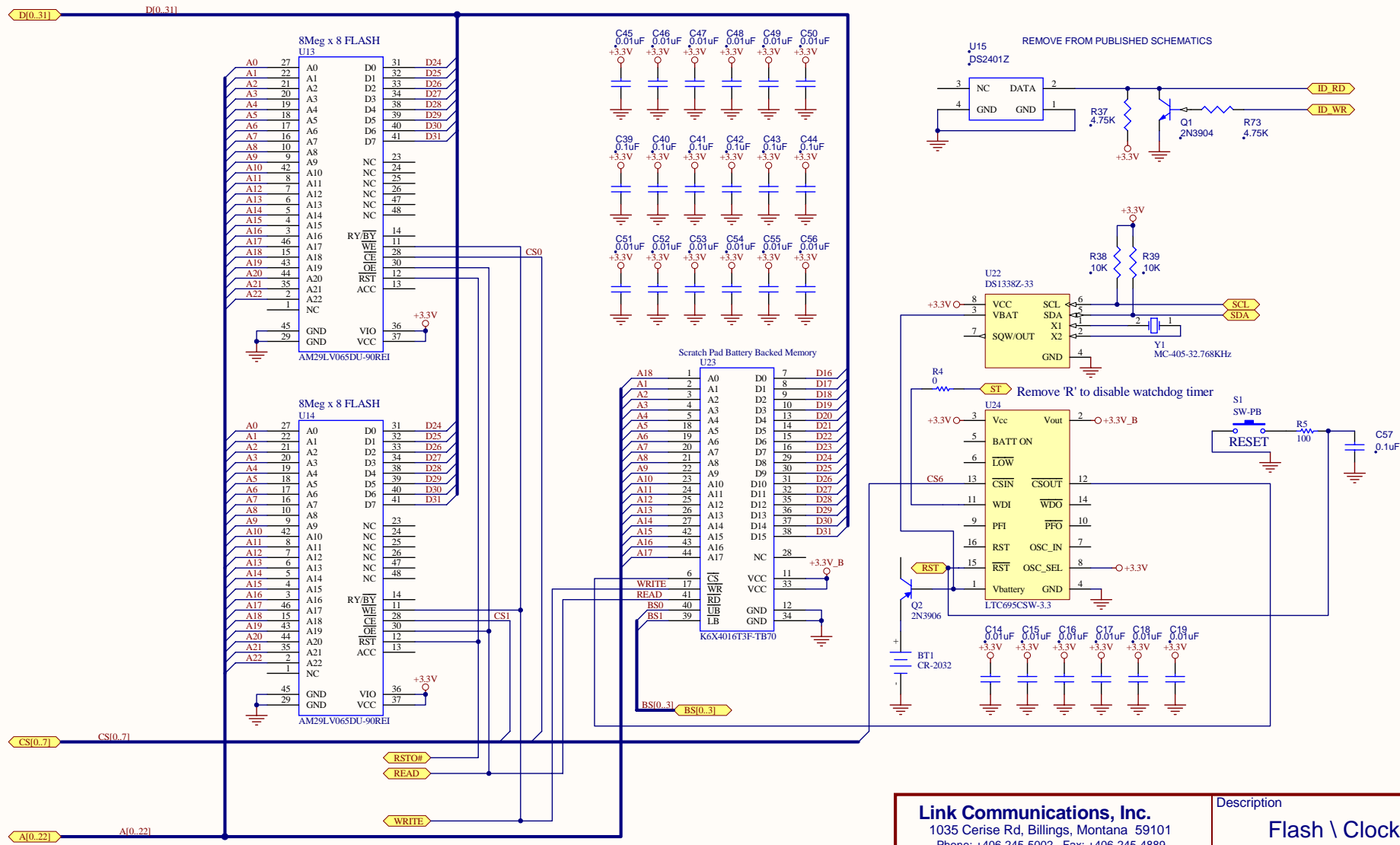


Link Communications, Inc. 1035 Cerise Rd, Billings, Montana 59101 Phone: +406-245-5002 Fax: +406-245-4889		Description Connection Sheet		
Drawing Number TCB-Processor	Date Aug. 31, 2005	Revision C1	Sheet 1	Total 8

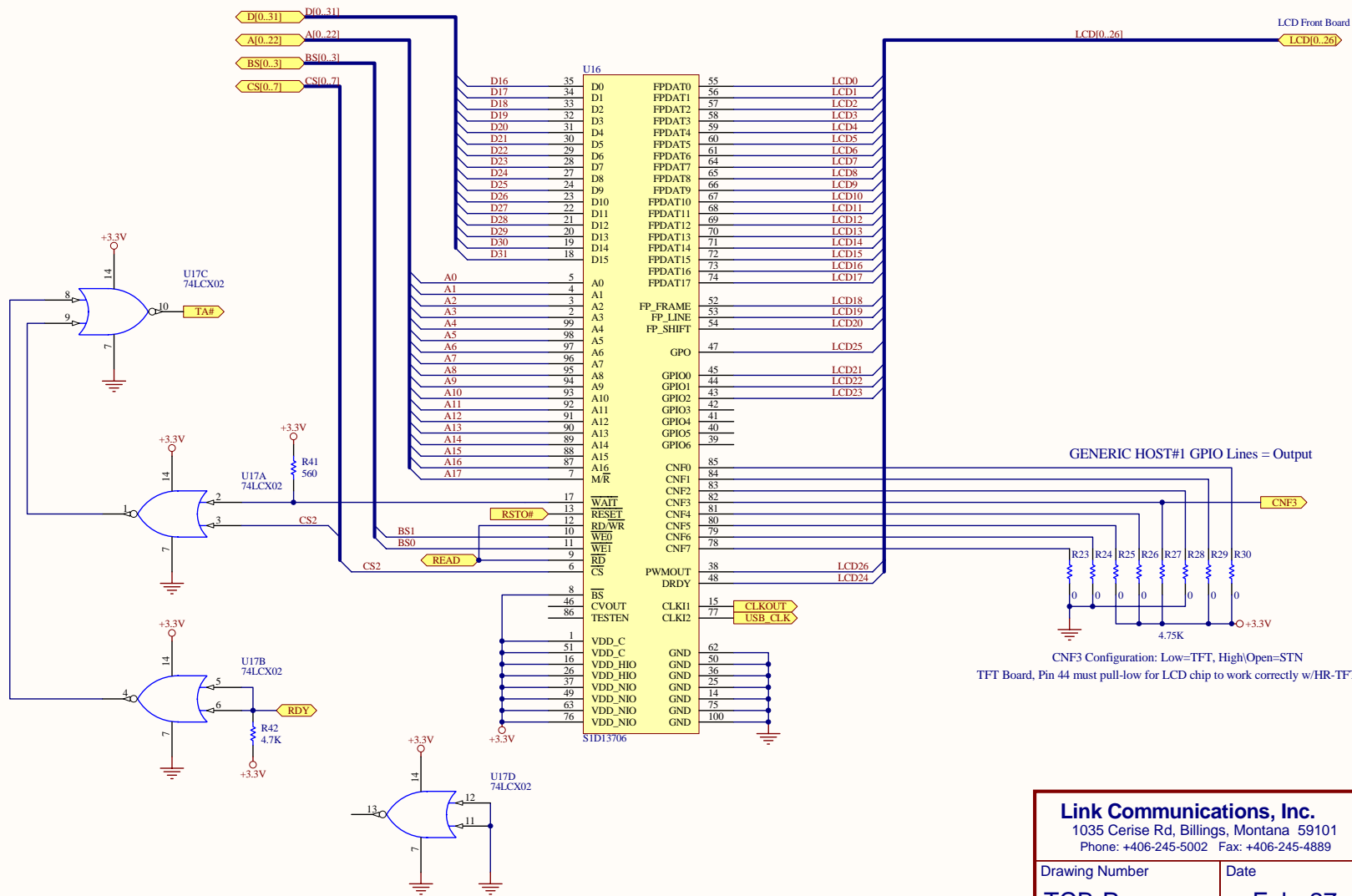




Link Communications, Inc. 1035 Cerise Rd, Billings, Montana 59101 Phone: +406-245-5002 Fax: +406-245-4889		Description Ethernet Interface		
Drawing Number	Date	Revision	Sheet	Total
TCB-Processor	Sept 19, 2003	A	3	8

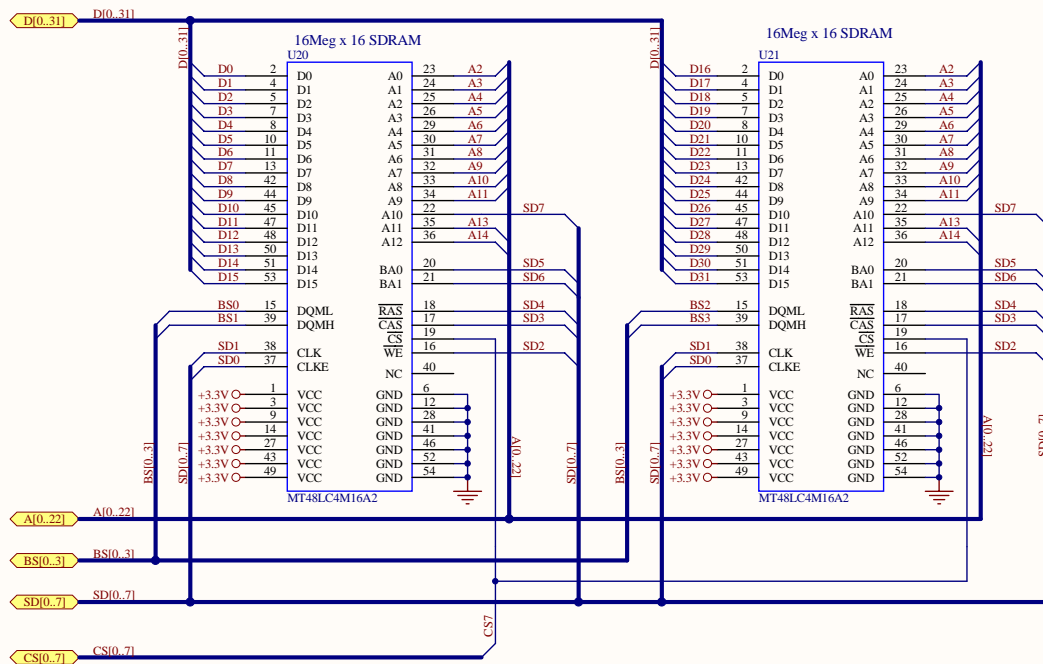
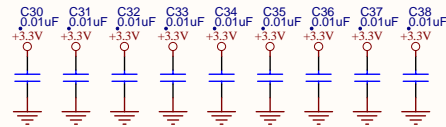


Link Communications, Inc. 1035 Cerise Rd, Billings, Montana 59101 Phone: +406-245-5002 Fax: +406-245-4889		Description Flash \ Clock		
Drawing Number	Date	Revision	Sheet	Total
TCB-Processor	Sept. 07, 2005	C2	4	8



Link Communications, Inc. 1035 Cerise Rd, Billings, Montana 59101 Phone: +406-245-5002 Fax: +406-245-4889		Description LCD Interface		
Drawing Number	Date	Revision	Sheet	Total
TCB-Processor	Feb. 27, 2004	C	5	8

Link Communications, Inc. 1035 Cerise Rd, Billings, Montana 59101 Phone: +406-245-5002 Fax: +406-245-4889		Description Power / RS232		
Drawing Number	Date	Revision	Sheet	Total
TCB-Processor	April 20, 2004	C	6	8



Link Communications, Inc. 1035 Cerise Rd, Billings, Montana 59101 Phone: +406-245-5002 Fax: +406-245-4889			Description SDRAM		
Drawing Number	Date	Revision	Sheet	Total	
TCB-Processor	Sept 01, 2003	A	7	8	